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PREFACE

One of the most characteristic features of agriculture in the Chinese People's Republic is its diversity, which is conditioned to a large degree by the natural extremes of this country. Within the huge territory of China there exists a range of geographical zones with varying climate, soil and vegetation. Nor is there any great uniformity in the natural conditions within each zone, particularly if one compares the humid eastern areas where the climate is of the monsoon type with the dry western territory, with its sharply defined arid climate, or with the areas along the coastal lowlands or the intercontinental highlands.

These contrasts are clearly distinguishable on a soil chart. The highly complex mosaic of such a chart reflects great diversity in the soil conditions of this country. Almost every type of soil existing in Europe or Asia, with the exception of certain types of soil limited to northern regions, are to be found on Chinese territory. A map of vegetation would show the wide variety of vegetational conditions as well, ranging from the frozen Teresken mountainous deserts to the perpetual green of the tropical forests.

The different areas of China are also distinguished by their levels of economic development, by their national characteristics, the traditional forms of productive activity of the population, and their particular social usages. It is therefore natural that this country should be noted for the complexity of the geography of its agriculture and for the great regional differences in specialization, in composition of branches of agriculture, in the crop set-up, in technical agronomy and in methods of production.

The articles published in this booklet are devoted to the natural conditions and geographical characteristics of agriculture in several large regions, typical of the basic geographical zones of China: the Sinkiang-Uighur Autonomous Region, North-Eastern China (the provinces of Heilungkiang, Kilin, Liaoning, Sungkiang), the provinces of Szechwan and Shantung and, finally, the Southern Coastal region (the provinces of Kwangtung and Kwangoi.)

The Sinkiang-Uighur Autonomous Region is a large agricultural region, and includes various natural zones: arid steppes, semi-desert and desert with a continental and temperate (in the South) climate. The main feature of the agricultural geography of this region is the combination of nomadic and semi-nomadic livestock-raising which exploits the extensive pastureland of the steppes and semi-desert and oasis-type agriculture, which is concentrated, for the most part, in the foot-hills where the rivers issue out onto the plains and where there exist subterranean water resources.

The area of North-Eastern China is a typical example of the agricultural region of forest and steppe zones where the climate is of the temperate, monsoon type. The abundant summer rainfall and fertile soils have encouraged a wide development of agriculture on the plains and to some degree in the mountainous sections of this region. The existence of a goodly amount of arable land has provided the basis for increasing the marketability of production. North-Eastern China is one of the most important regions for the export of marketable grain and technical crops. The climatic conditions of this region - cold winters with little snow - have conditioned agricultural specialization in spring crops (wheat, kaoliang, ch'u-mi-sze and soy).

The province of Szechwan is a good example of the agriculture of the sub-tropical monsoon area. The warm winter and high degree of humidity has encouraged the development, in this province, of an intensive rice-growing economy with a large proportion of technical and sub-tropical fruit crops, including citrus crops.

An intermediary position between the sub-tropical and temperate zones is occupied by a group of provinces, the soil and climatic conditions and agriculture of which are of the transitional type. Chinese geographers assign this zone to the temperate belt. Shantung Province is a good example of this zone; it is situated in the monsoon area on the latitude of the sub-tropics but is characterized by its comparatively cold winter and generally inadequate humidity, especially during the period of spring vegetation. This province has much less suitable conditions for cultivating moisture-loving crops and perennial sub-tropical crops. The main crops cultivated in Shantung are winter wheat, soy, peanuts, cotton and also fruit crops which can be grown in the temperate belt.

The agricultural geography of the tropics, which is a relatively small area of China, is characterized by the Southern Coastal Region in the extreme south of the monsoon area of the tropical belt. The economic importance of this region of the Chinese People's Republic is particularly great inasmuch as its domestic needs are supplied by this region as well as valuable types of tropical agriculture products for export.

An analysis of the geographical conditioning of the development of agriculture in these regions helps to elucidate both the regional and the more general tasks involved in the agricultural development of China which face the Chinese people in their efforts to institute social and technical reforms in the national economy of the country. Among the most pressing problems in the development of agriculture in present-day China is the task of increasing, to a significant extent, the gross amount of agricultural production and sharply increasing the yielding capacity.

China, as a whole, is marked by the low arability of its land and the extremely small amount of arable land per population (approximately 0.25 hectares per person). The great majority of arable land is concentrated in the thickly populated eastern part of the country

where natural conditions are most advantageous - on the plains to the east of the provisory line Chi-chi-ha-et to Lan-chou to Ch'eng-tu to K'un-ming where the climate is warm and moist and the soil fertile. This area represents less than 2/5 of the total territory of the country, and more than 9/10 of the population and the cultivated lands of China are concentrated here.

The cultivated land of Chir . is intensively exploited. This is accomplished by means of a meliorative measure, elaborate soil fertilization and preperation, extensive use of artificial irrigation and also by repeatedly using the land in the course of the year. These and other methods are used in their efforts to attain a high degree of productivity on Chinese fields. In spite of this, the level of agricultural productivity has not provided the country with the necessary quantity of products. Since the establishment of the CPR, besides measures being taken to increase the productive output of areas under cultivation, efforts have been directed at increasing the area under cultivation by assimilating virgin lands. During four years of the first five-year plan (1953-1956), 4.2 million hectares of virgin land were assimilated. The total amount of virgin land to be assimilated during the three five-year plans (1953 to 1967) has been set at more than 30 million hectares. Assimilation of virgin lands represents a number of difficulties in China; these difficulties are conditioned by the diversity of conditions in the various regions of the country. As a whole China is characterized by its relatively small area of land which could be drawn into the agricultural economy at notable cost. According to various evaluations, the area of these lands is from 30 to 100 million hectares which is considerably less than the area of the already cultivated lands.

The largest areas of virgin lands are located in North-Eastern China (in Heilungkiang Province and in North-Western China (in the Sinkiang-Uighur Autonomous Region, Kanou Province and in the Autonomous Region of Inner Mongolia.) In Heilungkiang Province, virgin land, of which there are several million hectares, consists of steppe-land which has never been cultivated, along the banks of the large rivers. The soil is very fertile but is in need of amelioration because of the poor drainage system. As far as the climatic conditions of this region are concerned, they would allow for a wide range of agricultural crops of the temperate zone type. If artificial irrigation were used, it would be possible to grow early-ripening crops, and crops which require more warmth, such as rice. As compared with the rest of China, this region is the best suited to the assimilation of virgin lands in relation to expenditures on meliorative practices and irrigation; this is due in part to the possibilities of using large scale mechanization in this region.

The conditions for assimilation or virgin land, in the north-western section of the country, are much more complex, particularly in Sinkiang. In this arid region the lands can only be cultivated by

means of artificial irrigation which requires huge expenditures inasmuch as the water must be brought in from distant regions, not to mention the additional large expenditures on soil improvement which would be necessitated by the inevitable occurrences of soil-saltening.

In the old agricultural regions, to which the provinces of Shantung, Szechwan, Kwangtung, and Kwangoi belong, most of the land, which has remained uncultivated, is very unfertile or very salty.(coastal lowlands). In order to assimilate either of these categories into the agricultural economy, various ameliorative operations must be carried out. Most of the unexploited arable land in the moist, tropical and sub-tropical regions has a clay soil (krasnozem) which is extremely poor in mineral nutrients and humus. This soil is very difficult to work and disparages the growth of plants of the root-type. Moreover, these soils are very acid and many crops cannot be grown in them if they are left in their natural state. In order to assimilate this type of virgin land, special soil improvement operations would have to be carried out.

The massive coastal lowlands with their salty soils could only be assimilated by protecting them from seawater by means of special dikes so that a natural desalting process could take place. These lands would then become fertile fields where rice, cotton, wheat and other crops could be grown.

Thus all of the main masses of virgin land in China, with the exception of the lands of North-Eastern China, have substantial agronomical inadequacies in their natural state which could not be overcome without fairly complex and expensive ameliorate operations.

In 1958 there were many important changes in the development of Chinese agriculture. The country's agriculture achieved unprecedented heights as a result of the huge political and organizational work conducted by the Chinese Communist Party to awaken the creative initiative of the great masses of the Chinese people.

According to a report of the State Statistical Administration of the CPP on 26 August 1959, the gross output of grain in 1958 was 250 million tons which is 35% more than in 1957; the gross output of cotton - 2.1 million tons or 28% more than in 1957. The growth of production of soybeans - 4%, peanuts - 9%, dried tobacco - 48%, jute and cenafe - 3%. The eighth plenum of the Central Committee of the Communist People's Party, which was held in August 1959, laid down a program for raising the agriculture of the country. ("Pravda" 28 August 1959).

These outstanding accomplishments in agriculture are connected with the implementation, on a large scale, of eight important agrotechnical regimes which are based on an estimation and a generalization of the national experience in obtaining good harvests. The first of these is the extensive irrigational construction which has been executed in recent years. Thanks to this construction work, the irrigated area of China quadrupled during the ten-year period and reached 67 million hectares in 1958 which amounts to approximately one-third of the total

area under irrigation in the world. Thus Chinese agriculture suffers less and less from drought which used to cause serious damage to the harvests in almost all sections of the country.

A second important measure which has been taken to improve the harvest yield has been extensive utilization of fertilizers. In China, where available plough-land is worked over an extended period of time and very intensively, field fertilization has always been of great importance and at the present time, it is a basic prerequisite for obtaining good harvests. In 1958 fertilization increased considerably. In the absence of sufficient manufactured mineral fertilizers, various types of local fertilizers are widely used as are also bacterial and chemical fertilizers which are produced locally. A great proportion of these are earth fertilizers.

The third measure taken to improve the harvest yield is the reworking and improvement of soils. Starting in 1957, steps were taken to increase the depth of the plough-land. In the past the fields were ploughed two and three times deeper.

In connection with this the crops have been sowed more densely. Better seeds are in use; the plants are protected from damage and disease; agricultural equipment has improved and plant care as well. The implementation of these measures is considered a necessary prerequisite to winning the battle for continued agricultural improvement.

In connection with the practical problems of developing Chinese agriculture, geographical conditions are being studied and agricultural production is being regionalized. This work has not yet been completed. The articles in this booklet are concerned with the geographical and economic aspects of agricultural production in various typical regions and may help the Soviet reader to form a more accurate picture of the regional features of the agricultural geography of China and of the enormous tasks which lie before China in the reorganization of this important branch of its economy.

I. Description of the Natural Conditions of North-Eastern China in Relation to the Development of Agriculture and Forestry

by N. M. Kazakova

North-eastern China has its own special natural and economic conditions which are to a large extent conditioned by its geographical position. (This article is concerned with the section of the Chinese People's Republic which is located between the state boundaries of the USSR and the Mongolian People's Republic and the administrative boundary of the province of Hopeh and the south-western side of the Great Khingan.) As compared with other sections of the country, it extends very far to the north and is a transitional region between the cold expanses of Siberia and the sub-tropical regions of Central China.

North-eastern China is one of the coldest regions of the country. In winter the prevailing winds are from the north and the north-west; they are cold and dry and singular in constancy and strength. They are accompanied by a long, cold winter with little snow; the small snow cover allows for deep ground freezing, which, in turn, leads to the formation of a layer of seasonal eternal frost. Only in the very southernmost parts of this region is the winter any warmer.

In the summer the prevailing winds are from a southernly and south-easternly direction; these winds come from the sea and are warm and moist; not infrequently they give rise to cyclones. The summer here is therefore very humid but not hot. The maximum rainfall occurs during this season. The amount of precipitation fluctuates from one year to the next, depending upon cyclonic disturbances.

The amount of precipitation conditions to a large extent the river regime of this territory which is outstanding for both the seasonal and annual irregularity of the current; this irregularity is characteristic of the rivers of eastern Asia in general and particularly of North-eastern China.

The irregular distribution of precipitation over the year gives rise to sharp seasonal changes in the water levels. The lowest water levels occur in winter when the amount of precipitation is at its lowest and the water levels are highest, in a strict sense, in mid-summer, when precipitation is maximal. The water levels are still higher in summer because there is a greater amount of sub-soil water during this season when the eternal frost begins to melt and the ground has a low degree of water absorbency. All of this results in overflowing of the river beds and serious flooding. The irregularity of precipitation from year to year results in continual fluctuation in the water levels; in years when the precipitation is great, the maximum waterlevel is ten times greater than in average or dry years. This gives rise to an endless succession of dry years and years when the rainfall is so great that damaging floods are not infrequent.

A relief map of North-eastern China shows a succession of mountains and plains. The main orographical systems here are the eastern Manchurian mountains in the east, the mountains of the small Khingan in the north, the Great Khingan range in the west, the high Barga plains in the far west and the strip of low plains of Manchuria, Sanchiang and North Khanka in the central and north-eastern sections of this region. The mountains are not very high; as a rule they do not exceed 1000-1500 meters above sea level, although some of the peaks rise to 2500-2700 meters and higher. The plains of north-eastern China generally lie among the mountains at varying heights above sea level (from 0 to 800m.) They are distinctive both for their size and formation.

The irregular relief of this region, with its great differences in relative heights and places where the transition from the mountains to the plains is very sharp, contributes to the swift current of the rivers and flooding of the plains.

The type of soil and vegetation in North-eastern China is directly dependent on the particular features of climate, hydrology and relief of this region. The presence of seasonal eternal frost directly affects the processes of soil formation and conditions the wide distribution of meadow-land. The numerous swampy areas which occur at every altitude and type of relief in this region are also attributable to the eternal frost.

The great breadth of north-eastern China from north to south and from east to west and the diversity of the landscape of this region lead to great differences among its various sections. The meridional orientation of the mountains chains, which are natural barriers to moist sea winds from the east, is an important determining factor in the various types of landscapes to be found here. Studies have shown that the chief natural barrier against winds from the east is the Great Khingan chain. There is a great perceptible difference between the dry west, the considerably more humid east, the cold north and the warm south and also between the mountainous landscapes and the plains.

According to its various types of natural conditions, North-eastern China may be divided into the following categories: 1) the Manchurian plain with its meadow-steppe and cultivated landscape, 2) the San-chiang plain with its meadow-swamp lowlands, 3) the northern Khanka plain with its forest-steppe lowlands, 4) the Priamur plain with its cultivated and meadow-swamp landscape, 5) the semi-desert-steppe plains and foothills of the Barga, 6) the densely forested and forest-steppe medium-high mountains and foothills of the Great Khingan, 7) the densely forested foothills of the Small Khingan, 8) the forested medium-high mountains of Eastern Manchuria. (See Figure 1).

Each of these natural regions has its own economic importance. The plains are the most important agricultural areas; the mountains are the main timber areas.

THE PLAINS

The most important areas from an economic standpoint are the lowland plains to the east of the Great Khingan. To this group belong the Manchurian, San'tszyan, North Khanka, and Priamir plains.

The high Barga plains, which lie west of the Great Khingan, are not as well suited to agriculture but they are of great importance to the animal-raising branch of the economy.

I - The Manchurian Plain

The Manchurian plain is the largest plain in North-eastern China and is located at the center of a large inter-mountain stretch which abounds in large deposits of gritty sandstone, clay and loess.

Typical of this plain are its low altitudes (not exceeding 150-200 meters) and the evenness of its surface. The actual relief of this plain is a combination of low-lying, flat, semi-oval sections with higher plateaus and hilly places which is, needless to say, very conducive to the development of agriculture. The flatness of this plain makes it particularly easy to use agricultural machines to work the soil.

Characteristic of the climate of the Manchurian plain, like most of the other regions of North-eastern China, is its dry, clear, windy and cold winter, which lasts, in most of this region, from November through March; and a warm, humid summer.

The fluctuations in summer temperature on various parts of the plain are small; the mean temperature in July in the north is around 22-23°, in the south, it is 24-25° C. Rising summer temperatures occur here in a basically north to east and south to west direction. (Figure 2) Temperature differences in winter, on the contrary, are very sharp; the mean temperature in January in the north is around -23, -24°, in the south it is only -8, -10°; temperature rises occur during this season in a north-south direction (Figure 3).

There is a great fluctuation in absolute temperatures from year to year both in the summer and in the winter. For example, there are years when in July the temperature does not go above 8° or rise to 40° and higher; in January the temperature can rise above 0 and fall as low as -44°. In other words, if the amplitudes of the mean temperature for winter and summer are 10-12° in this region, the amplitudes for the absolute temperatures can be as high as 30-50°, which is of great importance from an agricultural standpoint.

In amount of precipitation the Manchurian plain belongs to the temperature zone. The amount of precipitation varies over the territory of this plain; it increases from north-west to south-south-east. In the north-western section of the plain, the annual amount of precipitation is 400-500 MM, while in the south and south-east it is 600-700 MM. Maximum precipitation occurs in July when 120-140 mm fall in the north-western section of the plain; in the south and south-east 160-180 mm

(Figure 4); the lowest precipitation occurs in January. In summer the precipitation usually occurs in the form of heavy rainfalls, in the winter it is usually snow although the snow cover here is very slight. The snow cover lasts from 120 to 140 days in the north of this plain, in the far south, it lasts around 20 days. In the northern section, eternal frost to a depth of 2-3 meters is formed.

Spring and autumn in this region, as in most of the territory of North-eastern China, are very short. In most of the Manchurian plain, spring begins in April and terminates at the end of May; the spring is dry and quite windy and there are frequent dust storms. Autumn begins in September; during the day the temperature is still relatively high but at night it often drops below zero, especially in November.

The period of vegetation on the Manchurian plain is relatively short in the north - around 140 days, and in the south - 150-180 days. (Figure 5). This is sufficient for the development of agricultural crops but, as a rule, allows for only one harvest per year.

Agriculture here is further benefited by the fact that most of the annual precipitation falls during the warmest months of the period of vegetation; thus there exists a co-occurrence of maximum heat and moisture. However the sharp fluctuations in absolute temperatures and the frequent occurrence of late spring and early autumn (and sometimes summer) frosts can be very damaging to many agricultural crops and therefore only the crops which are not too sensitive to temperature changes can be grown here. Moreover, the small amount of winter precipitation combined with the light snow cover and in some places actual absence of snow cover tend to hinder cultivation of winter grains and perennial fodder crops, for which reason only spring crops and primarily the early-ripening variety are grown here.

An adequate precipitation in the spring, when the plants are just beginning to grow their leaves, detracts from the growth of agricultural crops by increasing evaporation from the soil surface which has a drying effect. Excessive precipitation during the second half of the summer is also harmful to the plants; it damages the ripening wheat and leads to crop damage through fungus diseases; it also makes it more difficult to harvest grain and hay.

The Sungari, Monni, Hu'ian, and Liao rivers and their tributaries flow through the Manchurian plain. They are not evenly distributed and certain parts of the plain are better irrigated than others. The best water supply is in the north-east and the north-west, which are drained by the rivers of the Sungari basin; the south-eastern section is also well irrigated by the rivers of the Liao basin. In the central and lower section of the plain and its south-western section, there is almost a total absence of active water resources; typical of these sections are small salty lakes, swamps and salt-marshes.

The valleys of these rivers are wide and flat; they are frequently swampy and have series of terraces. The rivers flow through winding beds which are narrow as compared with their valleys; the banks are low

and threaded with deposits of marl; there are many tributaries, inlets, islands and shoals. The descent of the riverbeds is gradual and the current is slow.

Typical of the rivers of this plain and of north-eastern China as a whole, are the sharp fluctuations of the water levels. The water reaches the high mark in summer (July and August) during the rainy season; some years the summer rains are so abundant that large stretches of the plain are flooded.

On the rivers of the Sungari basin, there is also substantial flooding in the spring: in early spring - around the middle of April, in the late spring - in May, and in the early summer - in June (Bedarev, 1934). Early spring flooding is caused by blockages of floating ice. The high water level in May is caused on the one hand by melting snow in the Eastern Manchurian mountains (where the Sungari originates) and on the otherhand by sub-soil water after the ground has thawed. The June flooding is caused by water from the Great Khingan, where the snow melts later; this rise is usually less marked than the one in May. Spring flooding on the Nonni occurs a little later and summer flooding earlier because of the more northerly position of its sources.

On the rivers of the Liao basin spring flooding is very slight because the amount of melted snow water is very small due to the meager snow covering in the southern part of North-eastern China. As noted by V. A. Anuchin (1948) the water regime of the Liao is greatly affected by its left tributary, the Hun, which takes its source in the Eastern Manchurian mountains. In these mountains the amount of atmospheric precipitation is much greater than on the plain which results in a much greater rise in the water level on the Hun during the rainy season than on the Liao. The amount of water on the Liao is frequently determined by the rise and fall of the water level on the Hun; there is a frequent occurrence of flooding which cannot always be contained by the dikes.

Thus the hydrological system of the Manchurian plain has a dual effect on the development of its agriculture. On the one hand, the plain is cross-sected by a large number of rivers which guarantee the fields and pasture-land an adequate amount of moisture. On the other hand, the inconstancy of the water regime leads to frequent overflow, and not infrequent serious floods. During the rainy season, when the rivers overflow their banks and often change the direction of the current, the land along the river banks becomes inundated and even the lower terraces are flooded; swampy areas turn into lakes. This is particularly true of the area between the Nonni and the Sungari. For this reason, the lower sections of the plain cannot be exploited for agricultural purposes. There are years, as already indicated, when the flooding is so serious that the water seeps into the higher agricultural sections of the plain causing crop damage and destruction to settlements and roads. This sometimes seriously damages the economy of this region. In the past the local population has fought these floods by building earthen dikes. Since the establishment of the People's Republic, when

it became possible to carry out operations on an incomparably larger scale, the regulation of the river regime has been in planning and a series of hydro-technical organizations have been established. When these measures are put into effect, the threat of damaging floods will be diminished and it will be possible to assimilate additional large stretches of the plain.

The predominant vegetation of the Manchurian plain is of the meadow-steppe variety. The virgin sections of the northern part of the plain are covered with meadow-steppe herbaceous-grassy vegetation of different types with a predominance of feather grass and vostrets. Large areas are covered with salt-marshes, especially along the banks of the many soda lakes. In the eastern part of the plain the steppe-type vegetation is accompanied by arboreal growth in the form of groves and individual trees. In the southern part of the plain, the landscape is cultivated. In the south-west there are many deposits of sandstone and salt-marshes.

Along the valleys of the rivers and the ravines there are small groves, primarily vyaz groves with an admixture of asp, oak and wild apple. The land along the rivers is mostly meadow, in places soggy, hillocky swamps and sandstone dunes. They are particularly apparent along the Sungari which is very wide in places.

According to recent information from soil studies made in the northern part of the Manchurian plain, there are various types of meadow soils (Sung Ta'chuan and others, 1958; Kovda, Bekker and others, (1958). Several of the investigators call these soils meadow-chernozem soils (Gerasimov and Ma Yun'chi, 1958) or degenerated chernozem and chernozem-type soils of the plains (Gordeev, 1954).

The root system of the rich grassy vegetation of the plain transforms the alluvial marl deposits and enriches the humus. As a result of this the soil has a good crumbly substance and a high humus content. The proximity of the layer of seasonal eternal frost, which lies at a depth of from 1.5 to 2 m., conditions the permanent water content of these soils. The eternal frost melts annually before the middle of July and August which creates free, capillary water during the period of vegetation. This water rises to the surface and nourishes the meadow vegetation.

The meadow-type soils in various parts of the plain are not identical. On the higher sections of the plain, including the river terraces, the soils are dark-colored; on the lower terraces, they are average (the humus range is from 30-40 cm) and on the high terraces, they are good and even superior (the humus range is more than 40 cm). In the lower sections, which are watered by the rains and floods, the soils are less good, and dark-colored (the humus range is less than 20 cm.) In the very lowest sections where meadow-type soils are combined with swampy areas, the soils are of the clay-meadow type.

These meadow soils are highly fertile. They have been cultivated since olden times and because of the eternal frost regime of subsoil waters, good harvests can be obtained on these solid even in dry years. As V. A. Kovda (Kovda, Bekker and others, 1958) points out, there have been instances when, even without using fertilization, as much as 40 centers per hectare of wheat have been harvested on these soils.

According to data established by the members of the Heilungkiang expedition, meadow soils are included in the virgin land reserve, which is subject to gradual assimilation. In order to assimilate these soils, no special measures are required, although it would be desirable to improve the plough-land by means of deep meliorative autumn ploughing and periodical application of black fallow. (Kovda, Liverovskiy and others, 1957). If the meadow-clay soils are to be assimilated, preliminary meliorative operations to regulate the river flow, by means of a network of small canals and deep drains, must be performed. In rainy years the flow of surplus water, in places where the soils are of the dark-colored meadow type, must also be directed because an excess of moisture in these soils increases the difficulty of gathering the harvest

In the northern section of the plain, the soil undergoes a salting process, which expresses itself outwardly in the presence of salt-marshes. These are distinguishable by the discoloration of the soils and the characteristic type of vegetation which is predominantly astragalus and leepedetsy (K'ou Sui-yu-i, 1951). The salt-marshes are situated mostly on the lower reaches of the Nonni River, in the lower sections where the soil is argillaceous and loamy and where there is no system of drainage. According to soil study information (Kovda, Bekker and others, 1958), a process of soda salting occurs here which is caused by the chemistry of the sub-soil waters. The accumulation of soda in soils of heavy mechanical composition indicates a deterioration of their agro-physical properties. The soils lose their structure and their water absorbency; they become swampy and lose their tractability For this reason only a small part of these soils are exploited agriculturally at the present time and, then chiefly for hay and livestock fodder. In the future, when a number of amerliorative practices have been carried out, including chemical improvement operations, it will be possible to exploit the sections of the plain which have salty soils to a greater extent for livestock raising.

In the southern section of the Manchurian plain, according to I. P. Geramisov and Ma Yung-chi (1958), the higher sections and the foothills have brown, forest type soils and in the lower sections, the soils are of the light-brown, meadow-brown primitive type. Moreover, on the watershed between the Sungari and the Liao rivers the soils are of the meadow-chernozem type. In the western part of the southern section of the plain, there are many sandy deposits. Most of the southern section of the Manchurian plain is being exploited agriculturally; nevertheless, there are still many strips of virgin land. Most of them are in the west where droughts are prevalent and where the sandy surface

of the plain is either covered with sparse grassy vegetation or absolutely bare. There are also unassimilated stretches of land in other parts of the plain, particularly in the low riverain flooded sections where there are many swamps and salt-marshes. The operations which are being carried out, at the present time, to improve the natural conditions of this part of the plain, particularly the forestry operations, grass planting and increased irrigational construction, will facilitate more extensive agricultural exploitation of the land which is now lying in waste, in the near future.

If one were to speak of the internal differences within the Manchurian plain and of the differences in the economic assimilation of its various sections, dividing lines should be drawn between the Nonni-Sungari plain, the Ch'ang-ch'un plain, the Liao lowland and the Hsi-liao River plain.

The Nonni-Sungari plain, which lies farther north than the others, is characterized by unfavourable climatic conditions. At the present time, only part of it is being used for agricultural purposes. The basic agricultural crops here are corn, sugar beet and soybeans. Within this plain there are wide stretches of virgin land which have not yet been assimilated but which could be put to use.

Along the lower reaches of the Nonni River, where the land is swampy and there are many salt-marshes, the valuable meadows are partly used for making hay and fodder. If the necessary improvements are made, including, as mentioned above, chemical improvement operations, these lands could be used to a greater extent for the development of animal husbandry because grasses of the cereal and bean families grow well in slightly salty soils, and have a high nutritional content.

The Ch'ang-ch'un plain which lies between the Sungari and the Liao Rivers has a temperature climate and highly fertile meadow-chernozem soils. Economically, this plain represents the most developed agricultural region of the Manchurian plain. The most common agriculture crops grown in this region are soybeans, corn and also Kaoliang and ch'u-mi. These crops demand somewhat different types of natural conditions; ch'u-mi-sze and corn are drought resistant crops; soy demands a comparatively large amount of moisture. When moisture-loving and drought-proof crops are planted at the same time, there is a steady harvest both in wet and in dry years. Kaoliang is very dependable under any natural conditions because of its root system. This crop is used widely by the local population both for food and also for various economic purposes.

The Liao Ho lowland, which occupies the southernmost section of the plain, is the most developed region. Almost the entire surface of the plain is under cultivation thanks to the warm climate and also the excellent drainage system. Along with kaoliang which is extensively cultivated and corn and soybeans, which are also grown here, rice and

cotton are grown successfully in the lower part of the Liao Ho where the vegetational period lasts from 160-180 days and on the low flooded river sections which are periodically covered with fertile silt.

The Hsi'liao River plain, which is elevated, very dry and sandy is sharply different from the agricultural regions of the eastern section of the Manchurian plain. One of the reasons for the occurrence here of moving sand deposits is the irrational economic exploitation of this land which was, according to Chinese investigators (Liu Hsiang-t'ien, 1955) forest-steppe country 1000 years ago. At present, the Chinese population is successfully battling the sand deposits by means of forestration. They are using ash, poplar and oak trees for this purpose as well as various types of brushwood, including selitryanka, amorfa, willow, and pine. They are also planting grass to reinforce the sandy places.

From an economic standpoint, this plain has, up until now, been only superficially exploited and, to a large degree, for animal raising. Agriculture has developed mainly along the valleys of the Hsi-liao Ho and the Hsin-liao Ho where ch'u-mi-sze, kaoliang corn and millet are grown. As the sandy sections are reinforced, more land will be fit for agriculture, especially as the soil and climatic conditions here favour agricultural development.

II - The San-chiang Plain

III - The Northern Khanka Plain

These plains are located in the far north-eastern section of China and are the lowest plains in the whole region being described. The San-chiang plain, the name of which means the Three Rivers, is joined to the Manchurian Plain in the south-west by a narrow strip of the Sungari plains and in the north it runs into the Amur lowlands of the Soviet Union. The Amur, Sungari and Ussuri rivers flow through this plain. The Northern Khanka plain runs directly into the Khanka lowland of the Soviet Union and is irrigated by the Ussuri river and its tributaries.

Like the San-chiang plain, the Northern-Khanka plain is made up of large masses of marl deposits; the elevations are not very high (up to 100 meters in absolute height) and the land lies on a flat plane with isolated peaks and groups of peaks of up to 500 meters in relative elevation, relics of the original relief.

Near the mountains, the surface of these plains becomes a little more hilly. The rivers on these plains flow through wide flat valleys with series of terraces. The declivity of the river beds and rate of the current are not great, for example the Sungar' flows at a rate of from 0.9-1.2 meters per second (Bedarev, 1934).

Climate-wise, these plains closely resemble the northern section of the Manchurian plain and differ from it only in details. The winter here is cold (average January temperatures are from -20 to -22° C), in summer it is comparatively cool (average July temperatures run from 20-22° C). The annual precipitation is 500 mm but in some places it is more. The maximum precipitation occurs in July - around 12 mm. The snow cover is slight; it lasts around 140 days. The eternal frost does not lie very deep. The period of vegetation lasts here from 140-180 days. The warmest and most humid climate is in the lower central parts of these plains.

The low flat surfaces of these plains are periodically subjected to serious flooding. The most serious floods occur on the San-chiang plain where they are caused by overflowing on the Sungari and also on the Amur. The rise in the water level on the Amur is caused by flooding on the Zeya, the Shilka, the Argun and other rivers of the upper and central sections of its basin.

Poor evaporation, the flat countryside, bad drainage and an excess of moisture have conditioned the many swamps and meadows which typify the present-day landscape of these plains.

Chinese scientists base their supposition that these plains used to be covered with pine, deciduous and mixed forests on paleogeographical information (Sung Ta-chuan and others, 1958). The forests alternated with the meadows and swamps in the lower sections. Later, under the influence of man, the forests disappeared and, at present, they are to be found only in the foothills surrounding the plains and isolated spots on the plains.

Various types of meadow soils have developed on the San-chiang and Northern-Khanka plains. There are the unique "pan-chiang" soils (a popular term) and brown forest soils. Dark-colored meadow soils are to be found for the most part along the rivers. These soils are extremely fertile. On the terraces, which are composed of clay deposits (more often on the low terraces), there exists a combination of dark-colored meadow soils and "ban'tszyan" soils. The origin of these soils has not yet been determined. They are formed chiefly on heavy lake and river deposits and also on heavy products of rock weathering under a cover of forest (birch) and meadow vegetation. These soils are typified by the prolonged presence of water in the upper layer (at a depth of from 20-30 cm) under which lies the layer of clay which is not very absorbent. Chemical analyses show that the humus content in the upper layer of these soils is very high (14-24%).

The "pan-chiang" soils are very important agriculturally. Although certain sections of them are covered with deciduous forests because there are no closely-knit forests over a large area, Chinese experts consider them more suitable to agriculture. "Ban'tszyan" soils are good for growing soy, corn, wheat and other crops. When irrigated they can be used for rice cultivation as well. The physical-chemical properties of these soils can be improved by introducing appropriate systems of cultivation and fertilization.

On the terraces (mainly on the upper terraces) which are composed of sandstone deposits and on the hills where there is forest growth, the soils are of the brown forest type. When used for agriculture, these soils require organic and mineral fertilization. The poor brown forest soils to be found on the slopes are not recommended for agricultural assimilation. The medium-good and good brown forest soils which lie on flat surfaces are entirely suitable for cultivation even without improvements (Kovda, Liverovskiy and others, 1957). Where the land is flat and the rock beds have a heavier mechanical composition, the brown-earth process of soil formation is combined with meadow-type soil and forms brown meadow-forest soils. These soils are to be found here under meadow and brushwood vegetation and are completely suitable to agricultural exploitation.

Up until now the territory of the San-chiang and the Northern-Khanka plains has only been partially used for agriculture because of the high degree of swampiness and the excess of moisture in the soils. Research has shown that there are great masses of virgin land in this area which are completely suitable to agriculture as far as natural conditions are concerned and in particular to cultivation of fodder crops and pastureland. But in order to use these lands most advantageously, not only must a network of drainage canals be set up but even larger projects must be carried out to regulate the flow of the main rivers of this region - the Sungari and the Amur.

At the present time, improvement operations are still being carried out on a very small scale; they have been initiated in the region of the lower reaches of the Ussuri and the Sungari.

The main agricultural crops in the San'tszyan and Northern-Khanka plains are, at present, rice, wheat and corn.

IV - The Priamur Plain

In order to complete a survey of the lowland plains of north-eastern China, one must examine the small belt of plains which lies along the Chinese bank of the Amur from Fo-shan to the mouth of the Amur.

The south-eastern half of this belt which lies at the foot of the small Khingan, is apparently a continuation of the Zeysko-Burein plain of the Soviet Union at least according to its geo-morphological features and the composition of its marl deposits. This part of the plain is basically a low flat terrace composed of clay and sand-clay deposits. On the edge of this plain there are higher terraces where the sands are more gravelly and pebbly. The slopes of these terraces are partitioned off and in places their relief looks like a typical bedland.

In the south-eastern section of the Priamur plain there exists a variety of meadow soils and brown forest soils. Large sections of this plain have been put to agricultural use; the lower terraces are

mostly meadows and the higher ones are under crops. However there are also areas of virgin land to be found here which are either covered with mixed forests or an overgrowth of grassy vegetation. On the level terraces and the slopes of the terraces which have not been too seriously divided up by erosion, there is a possibility of extending the areas under cultivation and the fodder land.

The north-western section of the Priamur plain is a narrow belt of riverain terraced plains. The three upper terraces are cube or socle-shaped, the lower terraces are accumulative and are mainly composed of sand deposits. The best developed areas on this plain are the high terraces although they are not to be found everywhere and frequently the mountain slopes - the foothills of the Great Khingan - descend sharply to the river.

The only other terraces are to be found in certain sections of the valley; often they are so partitioned off that they look like relics. The slopes of the high terraces, just like the mountain slopes, fall sharply down to the river and in some places they are steep and craggy and have a convex outline.

The terraces along the river are often very swampy; the vegetation on these terraces is mostly meadow and shrubbery growing in meadow-swamp type soils. These terraces are partially used for pastureland and hay fields. On the lower terraces the soils are usually of the meadow and meadow-swamp types; on the upper terraces the soils are of the brown podzol type with forest vegetation. The forests are predominantly white birch, larch and asp.

In this region, the area thus far assimilated is not very large. Spring wheat is grown here and also corn, chu-mi-sze, and several other crops. This region can be further assimilated agriculturally on the lower terraces. The second and third higher terraces could be used for plough-land and also for hay fields and pastureland. In certain sections, measures must be taken to protect the land from flooding and to improve drainage.

V - Barga

It is customary to divide the Barga into two main sections according to its landscape - the northern section, which looks very much like the Soviet Baykal region, and the southern section which is a continuation of the Mongolian steppes. The Argun river is the natural boundary between these sections.

The relief of the Barga represents a combination of flat, semi-oval highland plains, which occupy most of its area, and low flat-topped mountains. The origin and morphological composition of the mountains and plains are not uniform. In the southern section of the Barga, the following divisions may be made: the flat accumulative plain which occupies the lower central section around Hu-lun, Nor (lake) the naked plain, which lies in the extreme south-west, the undulating plains at

the foothills of the Great Khingan and the low residual mountains to the west of Lake Hu-lun. The northern section of the Barga has much greater absolute heights than the southern section and is more mountainous. Its surface represents a succession of smooth low mountainous groups which run, for the most part from north-east to south-west; parallel to these mountains run shallow intermountainous depressions. The only exception is the far northern section of the Barga which lies between the Khaul, Derbul and Kan rivers and consists of a flat, alluvial valley (Kazakova, Nikol'skaya and others, 1958).

The plains of the Barga are mainly composed of marl-sand-clay deposits; in some places large sandy stretches are to be found. In the sections where the vegetation is sparse, dry winds have caused moving sands.

The climate of both these sections is sharply continental. There is a great difference between winter and summer temperatures, much greater than anywhere else in north-eastern China. In some years, the temperature falls almost to 50° C and the summer temperatures rise to 40° C, thus the amplitude of fluctuation of absolute temperatures is almost 90°. The average annual temperature in the Barga region is negative (-2, 5°). Practically speaking, only six months of the year (April-September and sometimes to October) have positive middle-month temperatures. The daily fluctuations in temperature are very great here, frequently exceeding 14°.

In amount of precipitation, the Barga belongs to the dry zone. The average annual amount of precipitation is 250-300 mm. The precipitation fluctuates greatly from season to season and from year to year. It increases from west to east under the influence of the moist eastern monsoon winds. Evaporation in the Barga region is very high and exceeds, to a significant extent, the amount of precipitation. The period of vegetation lasts from 100 to 120 days.

The winter is long (it lasts from November to March), cold, dry, sunny, very windy and not very snowy. The average temperatures in the coldest month - January - are -26 - 28°. The average temperatures in all the winter months are less than -10°. In the spring and autumn they seldom rise above 0°. The amount of precipitation in winter is very small - it averages bearly 2-4 mm and the ground therefore freezes to a significant depth (up to 4 meters). The only months when freezing temperatures do not occur are June, July and August. The summer in the Barga is hot (the average July temperature is 21°) and dry although the largest amount of precipitation falls during this season (around 200 mm or about 70% of the annual amount).

The hydrographical system of the Barga is poorly developed although in the past this region was well supplied with water which is attested to by traces of the ancient hydrographical system in the form of dry valleys and basins. During the dry season most of the rivers of this region become completely dry; during the summer and spring rainy season, the water levels on the rivers and lakes rise and in some years the rise is very great and the waters overflow the banks and flood the adjoining plains.

The soil cover of the Barga is made up of various types of light brown soils; in some places there are also chernozem, meadow-swamp and salt-meadow soils. The light-brown soils contain humus (3-5%). The greater part of the soils of the Barga are noted for their sandiness.

The predominant vegetation of the Barga is steppe vegetation. There are sections among the steppes where semi-desert and desert vegetation grows. The central and eastern sections of the Barga, where the annual precipitation is 250-300 mm, are covered with high-grass steppes. The western section, where the annual precipitation is around 200 mm, is predominantly low-grass steppe-land.

The type of steppe vegetation changes in relation to the soil covering. As a rule, vostrets, koster, lucerne, chiy and other types of vegetation grow on the light-brown soils of the Barga. On the salty soils the most widely distributed types of vegetation come from the marevye family. On the sandy soils grow kumarchik, koster, pine, karagan, lespedetsa, astragal, ostrolodochnik and others. All of these plants are characterized by their long roots, fast growth and adaptability to temperature and soil conditions. On the meadow-swamp soils, which are frequently salty, grow the reed, the small aquatic pine and other hydrophiles.

The natural cover of the Barga steppes is well-preserved. Grassy vegetation occupies an average of more than 50% of this region; 95% of this area is pastureland. The average height of the steppe-grass is 40 cm. Most widely distributed in the Barga region are the herbaceous grasses; although bean and blossoming grasses are also found here. Many of these grasses make good fodder. Especially high in nutritive content are the vostrets, the kilocnyak, couch-grass, zhitnyak, fescue, lucerne, koster and myatlik.

Because of the high nutritional content of the grasses, the main branch of farming in the Barga is animal husbandry. This is the most important animal raising region in North-eastern China. Crop growing has been complicated here by the fact that the light-brown soils are not very fertile, the hydrological and climatic conditions of this region are also rather unsuitable to crop cultivation and the inadequate amount of precipitation makes it extremely difficult to work the soil. It has been established that the annual 185 mm of moisture in the environs of Manchuria station does not suffice for the development of agriculture (Yang chen-chang, 1950). Even the sections along the rivers and lakes which are the best supplied with water and are covered with meadow-swamp soils are not suitable for plough-land because they are subject to periodic droughts and floods resulting from flooding on Lake Hu-lun, the Orchun Gol and Argun rivers and others which drain into the plain. These lands can only be assimilated when the flow of the Argun river has been regulated.

Only in the far northern part of the Barga, in the so-called plain of the Three Rivers, does the population engage in crop cultivation along with livestock raising. This flat, accumulative plain is made up of the alluvial deposits of the Khaul, Derhul and Ken rivers, on which chernozem soils have developed.

Along the valleys of these rivers, there are also meadow and meadow-swamp alluvial soils with veynikovo-sedge swampy meadows. This part of the Barga is well irrigated, the soils here are fertile. The local population successfully grows spring wheat, barley and vegetables.

MOUNTAINS

The mountainous territory of North-eastern China is less important agriculturally than the plains. The principal forested regions of the country are located here. The relatively well-preserved state of the forests of North-eastern China can be explained by the fact that for several centuries under the Manchurian ch'ing dynasty, it was forbidden to fell trees in these forests - the ch'ing dynasty protected Manchuria as the country of its forbears. Forest felling, hunting, ploughing and mineral exploitation were forbidden. Major forest felling began under the Japanese occupation, but part of the large forested areas have survived. In order to preserve the timber resources, the government of the CPR is putting into effect measures which will control the felling and replenish the stand of trees. The most forested area is the northern section of the Great Khingan, the Small Khingan and the Eastern-Manchurian mountains. As far as natural conditions are concerned, these mountains are not identical and consequently the economic exploitation of these territories differs to some extent.

VI - Great Khingan

The Great Khingan is a well-defined mountain range, which is oriented in a generally meridional direction. The average elevation of this range is 1200-1300 meters above sea level; the highest peaks rise to 1700-2000 meters and the elevation of the range as a whole increases from north to south.

The relief of this range is predominantly smooth. The peaks of the mountains are usually flat, the sides are sloping and are covered as a rule by particles of natural rock and small-grained material from the weathering crust. Towards the bottom the slopes spread out and become very slightly sloping deluvial trains, framed by the foothills of the mountains. Typical of the Great Khingan are the wide, flat-bottomed swampy valleys which dominate the landscape. The upper parts of the valleys are especially wide and vaguely defined.

Due to the great length of the Great Khingan from north to south, the climate, soil and vegetation of the northern and southern sections are conspicuously different.

In the northern section of the range (north of the Khalkhin Gol and T'ao-erh Ho) the average January temperature is -28°, the absolute temperatures fall to -50° and even lower; the non-freezing period lasts less than 120 days; snows lie on the ground from five to six months of the year; the rivers are covered with ice half the year. The layer of eternal frost does not lie very deep. The average July temperature is 20° but in August the temperature already begins to drop below freezing. The annual amount of precipitation increases from north-west (where it is 100 mm) to south-east (where it is 400 mm). The maximum precipitation falls in July.

In the northern section of the Great Khingan, the processes of frost weathering are very intense and are closely tied to the frost phenomena - soliflyuktsionnye, termokarst and others and also erosion, particularly lateral erosion which is conditioned by the irregular river regime and the presence of eternal frost which prevents the water from penetrating deep into the ground. As a result of these processes, landslides, osypi and oplyviny are formed which redistribute the marl deposits, carrying them down the slopes to the river valleys. The large number of swamps in this region is also attributable to the eternal frost; most of these swamps are to be found in wide flat lowlands along the rivers.

The northern part of the Great Khingan is a taiga region as far as the type of soil and vegetation to be found here are concerned. The vegetation consists of light-coniferous taiga which becomes mixed coniferous-broad-leaved deciduous forests towards the south-east, and even farther south it is replaced by forest-steppe land. South of the 52° parallel of latitude, the western slopes of the Great Khingan become forest-steppe, and south of the 50° latitude, the eastern slopes as well.

The processes of soil formation are closely associated with the prevalence of light-coniferous taiga. The main process of soil formation is the formation of podzol which in most cases is accompanied by the clay (gleevym) process in the lower layer of the soil profile. The type of soil formation depends on the type of rock bed. For example, on the coarse clay alluvion, humus-clay slightly peaty soils are formed, which sometimes undergo a superficial chemical change which forms podzol; the soil on the clay alluvion is clay-podzol. Both of these undergo a sharp seasonal moisturizing process and have a tendency towards swampiness. In the area where there are mixed coniferous broad-leaved forests, the podzol forming process is combined with the brown earth forming process. In places where the ground has a heavy mechanical composition, brown soils are formed with varying degrees of podzol and in the sandy places, there are brown-podzol soils. In the lower sections of the valleys, meadow, meadow-swamp and swamp soils prevail.

All of the above-mentioned various types of soils have a low natural level of fertility. The brown podzol, clayey soils are the most fertile of these. They are found, mainly, on the high terraces of

the Amur and can be used for agriculture. The other soils of the light-coniferous taiga are unsuitable for agriculture because they are very rocky and swampy and water-resistant and the temperature of the top soil layer drops during the first half of the vegetation period because of the slow thawing process of the eternal frost. If necessary, these soils could be used selectively if large expenditures were made on basic improvements. These improvements would include drainage, water regulation, rockdrilling, stubbing, lime application, organic and mineral fertilization and also anti-erosion measures which are especially necessary in the sections where the brown-podzol soils of a light mechanical composition have been subjected to a good deal of erosion (Kovda, Liverovskiy, Sung Ta-ch'eng, 1957).

It is thus apparent that the whole complex of natural conditions existing in the northern section of the Great Khingan, especially current processes of relief and soil formation, are not conducive to the development of agriculture in this region. Only the sections, where the soil is of the brown-podzol clayey type, can be agriculturally exploited and these occupy only a small area; the water-meadows can be used for animal husbandry. Therefore agriculture has no practical significance in this region. The natural conditions of this section of the Great Khingan are entirely suitable for the development of the timber industry and hunting. The mountains, as was mentioned above, are covered with light-coniferous taiga; the species of trees in the taiga are fairly uniform. The most prevalent tree here is the Daurskaya larch - deciduous trees occupy approximately 70% of the forest area of the Great Khingan. In the south-eastern section of the Great Khingan which borders on the Barga, there is a lot of flat-leaved birch.

In the sand deposits and the upper sections of the slopes in the northern part of the Great Khinga, one finds small amounts of pine. The upper forest limit in the Great Khingan lies at an altitude of around 1400 meters above sea level. The high belt (from 1200 to 1400 meters) is mostly shrubbery with occasional short-trunked deciduous trees. Below 1200 meters lies the coniferous forest which is mainly composed of deciduous trees and pine; the deciduous trees prevail on the northern slopes, the pine - on the southern slopes. In the lower sections of the slopes the deciduous taiga is replaced by secondary birch-deciduous forests and birch-asp forests. The birch-asp forests also lie in the sections along the rivers. In the valleys of the large rivers steppe-type forests with meadow and meadow-swamp soils extend far into the north (in the more moist northern sections).

Most of the species of trees mentioned above, growing in the forests of the Great Khingan, can be exploited industrially. Of particular economic interest is the Daurskaya larch which is the main source of wood in China. This tree has great stamina; it can withstand severe winters, late frosts, grows easily on ground where there is eternal frost and on any type of relief. Moreover, the Daurskaya larch

multiplies at a great rate and along with the white birch quickly covers areas which have been burnt out or felled which is also a valuable economic property of this tree.

Logging is the main outlet of the economy of the northern section of the Great Khingan. The forests of the northern Khingan are inhabited by many valuable animals - squirrels, deer, elk, otter and other hunted animals. According to information released by the Heilungkiang expedition, the main economic task to be done at the present time in the mountains of the northern sections of the Great Khingan is forest preservation, and where necessary, reforestration.

The climate of the southern section of the Great Khingan is much warmer. The average January temperature is -14, -16°, snow lies on the ground a total of from 1.5-2 months, the average July temperature is 24-25°.

As for its soils and vegetation, this section of the Great Khingan belongs to the forest-steppe zone, the northern limits of which extend quite far south as compared with the territories which lie farther west and east because of the meridional direction of these mountains. As it extends southward, the forest-steppe thins out (a result of man's economic activity) and makes way for steppe-land. The annual amount of precipitation, which averages from 250 to 300 mm, encourages the growth here of high grassy vegetation. The steppes, as a rule, have an almost uniform grass cover and very high quality types of grass which are predominantly herbaceous, although leguminous and also flowering grasses are found here. All of these grasses are edible and the steppe region there provides excellent natural pastureland; the main branch of the economy here is animal raising.

The soils of this region are mainly brown forest and light-brown soils. On the eastern slopes of the southern section of the Great Khingan, there are also chernozem soils. The chernozem soils, combined with the warm climate and large amount of precipitation which falls on the eastern slopes of the Great Khingan, are conducive to the development here of crop cultivation as well; the main branch of the economy on the slopes of the southern section of the Great Khingan is already becoming a combination of crop cultivation and animal-raising. The main crops are kaoliang, ch'u-mi-sze, corn and millet. Large areas of this region, particularly in the south, are covered with sand deposits, in some places these are moving sands, which naturally hinders a speedy development here of agriculture. Just as in the south-western regions of the Manchurian plain bordering on the Khingan, which were described above, the best measures against sand deposits are forestration, grass sowing and irrigation projects. According to information from Chinese researchers, these operations are being increased from year to year and the sown area is increasing according (Economic Geography..., 1956).

VII - The Small Khingan

The Small Khingan is the lowest mountain range in North-eastern China. The elevations average 400 to 600 meters above sea level and only occasional peaks are slightly higher than 1000 meters.

In connection with intensive processes of physical, and particularly frost, weathering the mountains are covered with rocky sections and finer, crushed deluvial matter, which is sometimes quite large.

The Small Khingan mountains are typical naked low mountains. In the upper sections, the mountains are flat and the relief is smooth. The watersheds are flat and there are many traces of the ancient lake and river system. Everywhere you see small, round or flat-topped mounds with long gradual slopes separated by wide flat stretches with a swampy bottom which sometimes become crater-shaped. The steepness of the slopes and the depth of their partitions increases, as a rule, from top to bottom as a result of which the lower sections of the slopes are usually much steeper than the higher ones.

As to its natural characteristics, the Small Khingan resembles the northern section of the Great Khingan. The climate here is also characterized by an extremely severe, dry and prolonged winter and a short, humid, cool summer. However both the winter and the summer temperatures are somewhat higher than on the Great Khingan: the average July temperature is 22°, the average January temperature is -26°, and the amount of precipitation is somewhat greater. In July, 120-140 mm of precipitation falls. Snow lies on the ground 140-160 days, the soil freezes to a great depth as a result of which there is a predominance of seasonal, and in some places eternal, frost, which contributes to the great swampiness of the countryside.

The vegetational period lasts from 90 to 100 days in the northwestern section of this region and up to 160 days in the south-eastern section which is sufficient for growing winter crops. However crop cultivation is not very developed here and only in certain sections. One of the reasons for this is the unsuitable geo-morphological and soil conditions which resemble those described in the mountains of the northern section of the Great Khingan.

The Small Khingan mountains are thickly forested. In the northern section there are deciduous-birch forests where the Daurskaya larch prevails, as in the Great Khingan; in the southern section, the forests are coniferous-broad leaved with a predominance of Korean cedar and the transition from one type of forest to the other is very gradual. Under the deciduous-birch forests, soil formation is basically of the podzol type and is usually accompanied by a clay process. Under the coniferous-broad-leaved forests, the soil is formed by means of the brown earth process. In the valleys, meadow and clay soils prevail. Within the limits of the Small Khingan, podzol and brown forest soils prevail, in the valleys - meadow-swamp and swamp soils under grassy meadow-swamp vegetation. As was already mentioned, only

certain varieties of these soils are suitable to agricultural exploitation and these are mainly the brown podzol clay, meadow and brown forest soils.

The forests of the Small Khingan have great industrial significance. In the coniferous-broad-leaved forests, besides the prevailing Korean cedar, there are deciduous trees, the Ayanskaya fir, yew, birch and elm. The wood of the Korean cedar is extensively exploited for building material. It is durable, elastic and can be easily processed. The Ayanskaya fir and the larch provide a valuable source of wood. The wood of the yew is also highly valued, although this tree is noted for its extremely slow rate of growth.

VIII - The Eastern-Manchurian Mountains

The Eastern-Manchurian mountains, or as they are often called the Eastern-Manchurian mountain country, is situated on the far eastern edge of North-Eastern China. This region is very large and extremely complicated from the standpoint of its nature which to a large extent is determined by the complexities of its relief.

Characteristic of these mountains are a succession of parallel mountain ranges which run mainly from north-east to south-west, and also the wide inter-mountain tectonic hollows. The Eastern-Manchurian mountains are the highest mountains in North-Eastern China. The heights average from 1500-1700 meters above sea level but some of the peaks rise to 2744 meters (Pai-t'ou Shan).

From a climatic point of view, this is the most humid region of North-eastern China which is attributable to its proximity to the Pacific Ocean. The amount of annual precipitation is more than 750 mm and in the southern section of this region it is as much as 1000 mm. A large part of the precipitation falls from May to September. The winter and summer temperatures in the Eastern-Manchurian mountains are somewhat lower than on the adjoining plains. On the high peaks there is eternal snow. Because of the great breadth of this region from north-east to south-west, the sharp fluctuation in altitudes (from 500 to 2700) and the divergent degree of partitioning, the difference in climatic and micro-climatic conditions, in various sections of this region, is very great.

The erosive action of the rivers of the Eastern-Manchurian mountains is very intensive because of the special climatic features of this region. The river system is multiple, many rivers have a great fall and seriously erode the slopes. As opposed to the Great Khingan and the Small Khingan, deep erosion plays a large part here. The rivers also occupy the inter-mountain tectonic hollows, which are usually wider in the northern part of this region than in the south. In the past, these hollows were large rivers and huge lakes, as attested to by the marl deposits. In the Eastern-Manchurian mountains there are many hot springs which originated from the volcanic activity of these mountains.

The soils of the Eastern-Manchurian mountains, according to I. P. Gerasimov and Ma Yung-chi (1958) belong to the brown forest type. In the foothills of the northern part of this region, there are gray forest soils, in the river valleys - alluvial and, in places, clay soils. The latter are noted for their peat content of more than 1 m (Wan An-chiu, 1956).

The mountains are covered with thick coniferous-broad leaved forests. The most common coniferous trees are Korean cedar, Ayanskaya fir, silver-fir, and yew. The most common deciduous trees are Mongolian oak, maple, linden, hornbeam, nut Barkhat, birch and elm. Liana are very characteristic - grape, Aktinidia, Limonnik. The most valuable grass plant is Zhen'shen'.

In this region vertical zoning is very clearly defined. Chinese scientists divide this region into the following five vegetational zones (Chu Chi-fan and others, 1958): 1) heights of over 2100 meters - shrubbery 2) from 1800 to 2100 meters - the high deciduous forest of Erman birch and in places which are protected from the wind an admixture of asp, silver-fir and larch; 3) from 1000 to 1800 meters - coniferous forest of Korean cedar, asp, silver-fir with a small admixture of birch; 4) from 500 to 1000 meters - coniferous-broad leaved mixed forest of Korean cedar and an admixture of Mongolian oak, long-leaved elm, Amurskiy Barkhat, ash and others; 5) from 250 to 500 meters - secondary mixed deciduous forest of oak and asp.

The forests of the Eastern-Manchurian mountains, like other regions of North-Eastern China, are a valuable resource and are carefully protected. At the present time, forest management operations are being conducted; (timber farms) leskhozes are being organized, which are engaged in reforestration, forest preservation and studying methods of forest fire prevention. This region is being studied for future development of the timber industry.

Crop cultivation has also developed in this region but on a much lesser scale. The arable land is located in the foothills, in the places where the forests have been felled on the low mountains and also in the wide mountain valleys where the forests have been done away with. Here they sow beans, millet, corn, kaoliang, wheat and other crops; in the southern sections of this region rice is grown. In some of the valleys there are meadows.

CONCLUSION

Thus we see that as far as natural conditions are concerned, the plain regions which lie east of the Great Khingan are the most suitable areas of North-Eastern China for the development of agriculture. This may be attributed to the warm, moist summer and the good soils which are for the most part clayey and contain a large quantity of organic matter (in the virgin lands up to 30%) and have an excellent granular structure and a neutral or slightly sour reaction (Cheng Chao-shun,

1953). The even relief makes it easy to cultivate the fields with agricultural machinery. On the other hand, the territory which lies west of the Great Khingan and the southern part of these mountains where the large high-grass steppes are located are rich fodder resources and better suited to the development of animal husbandry.

Within North-eastern China, large areas of virgin land remain up to the present time; in order to exploit these lands, preliminary ameliorative operations of various types must be carried out as well as all kinds of agro-technical measures.

Elemental catastrophes - droughts and floods - are very harmful to the agriculture of North-eastern China. Great damage is also done by universal over-moisturization of the soil, which is caused by the abundant summer rains; this has resulted in the overwhelmingly large area of the plains. The effects of drought are partly neutralized by cultivating a wide selection of crops and also by simultaneous planting drought-resistant and moisture-loving crops which, to some extent, insure stable harvests, although at times the effects of drought, as well as flooding, are ruinous.

The most radical measure for combatting flooding is water regulation on the largest rivers of the territory, which is being accomplished by building large dams and reservoirs. This also makes it easier to effect various kinds of measures to combat over-moisturization of the soils, lack of moisture in the soil, swampiness and drought. In many cases the new lands can only be effectively assimilated after the rivers have been regulated, so that these lands are protected from the threat of inundation.

The realization of these projects will facilitate a great increase in the sown area and fodder lands of North-eastern China. For instance, when the flow of the Sungari, Nonni and Liao Rivers has been regulated, huge areas of virgin land within the Manchurian plain can be cultivated. Even in the lowest sections and the poorly drained sections where there are many lakes and swamps, it will be possible to increase the sown area when drainage and irrigation systems have been put into operation. When the flow of the Amur, Sungari, and the Ussuri has been regulated, large virgin land masses within the San-Chiang and Northern-Khankay plains will be made available for agricultural exploitation. When the flow of the Argun has been regulated, it will be possible to more fully utilize the Barga; in particular the virgin lands around Lake Hu-lun will be open to agricultural cultivation.

It is a well-known fact that the problem of regulating the flow of the Amur and the rivers of its basin is being tackled at present by the joint efforts of Chinese and Soviet scientists. A series of sites have already been appointed for building dams and future reservoirs; means of combatting over-moisturization of the soils, on the lower plains, are also being investigated. Work is being performed on the construction of new agricultural machines which can be used for working the soil and gathering the harvest under very moist conditions

where ordinary machines cannot operate. The problem of the Aur is a vital one for the Chinese and Soviet Priamur.

Large areas of virgin land in North-eastern China, both within the plains and on the mountain slopes, could be turned into arable land and pasture-land without radical changes if local improvement projects, reforestration and various agro-technical measures, etc., were established. Thus the possibility of new agricultural exploitation in North-eastern China is still very great.

No less important are the possibilities of extending the forest economy because the natural conditions of this area are perfectly suited to growing valuable species of trees. As has already been pointed out, the best prospects for developing the forest economy are in the northern section of the Great Khingan mountains, the Small Khingan and the Eastern-Manchurian mountains where there are good opportunities for reforestration.

Bibliography

Anuchin, V. A. "Geographical Essays on Manchuria." Moscow, 1948.

Bedarev, P. K., "Flooding in Northern Manchuria." "Manchurian Herald" 1934, No. 9. Wang An-ch'iu. "The Mountainous Region of the Eastern Part of the Northeast" "Ti-li Chih-shih" (per.), 1956, No. 6 (in Chinese)

Gerasimov, I. P. and Ma Yung-chih. "Genetic SoilsTypes within the Chinese People's Republic and their Geographical Distribution." Moscow, 1958.

Gordeev, T. P. "Soil Outline of North-Eastern China and the Eastern Part of Inner Mongolia" "Acta Pedologica Sinica", Vol. 2, No. 4, Peking, 1954.

Kazakova, N. M., Nikol'skaya, V. V., Timofeev, D. A., Chichagov, V. P. "An Analytical Experiment of the Quantitative and Qualitative Indices within the Physical-Geographical Regionalization of the Argun Area" "Problems of Physical Geography", Moscow, 1958.

Kovda, V. A.; Bekker, E. E.; Sal'nikov, S. E.; Zimovets, B. A.; Vasilevskaya, V. "Genetic characteristics of the Soils of the Amur Region" Collection of Scientific Reports of the Amur Expedition, Volume I, Peking, 1958 (in Chinese)

Dovda, V. A.; Liverovskiy, Yu. A.; Sung Ta-ch'eng. "Outline of the Soils of the Amur Region". "Izvestie AN SSSR, biol. series.", 1957, No. I.

Forests and Soils of China. Geographical collection. Translation from the Chinese, B. A. Mitbreyt and Ya. M. Berger, Moscow, 1955.

A Course in the Economic Geography of China, Peking, 1958, Vol. 2 (in Chinese).

Liu Hsiang-t'ian "Natural Features of Inner Mongolia." ZH. Ti-li Chih-shih 1955, No. 10 (in Chinese)

Margolin, A. B. "Priamur." Moscow, 1957.
Murzaev, E. M. "North-Eastern China (physical-geographical description)" Moscow, Academy of Sciences USSR Publication, 1955.
Sung Ta-ch'uan, et.al., "Soils of the Amur Basin and Their Agricultural Utilization." Collection of sicneitific Reports of the Amur Expedition, Volume 1, Peking, 1958 (in Chinese)
Physical-geographical regionalization of China (collection of articles) Issue I, Moscow, 1957.
Hou Hsueh-yu, "The Problem of Land Exploitation in the Northeast." "K'e-hsueh T'ung-pao", 1951, No. 2 (in Chinese).
Chu Chi-fan, et.al., "The State of Timber Reserves on the Right Bank of the Amur within the CPR and the Basic Problems in the Study of these Resources at the Present Time." Collection of Scientific Reports of the Amur expedition, Volume 1, Peking, 1958 (in Chinese).
The Economic Geography of the autonomous oblast of Inner Mongolia. Editor: Sun Ching-chih, Peking, 1956 (in Chinese).
Tseng Chao-shun, Soils of the Northeast". Zh. "Ti-li Chih-shih, 1953, No. 11 (in Chinese).
Yakovlev, A. A. "Climactic Survey of Northern Manchuria based on Data of the Meteorological Stations KVZhD. Harbin, 1934.
Yang Jen-chang, "The Climate of the Northeast". Zh. "Ti-li Hsueh-pao." 1950, Vol. 16, (in Chinese).

FIGURE APPENDIX

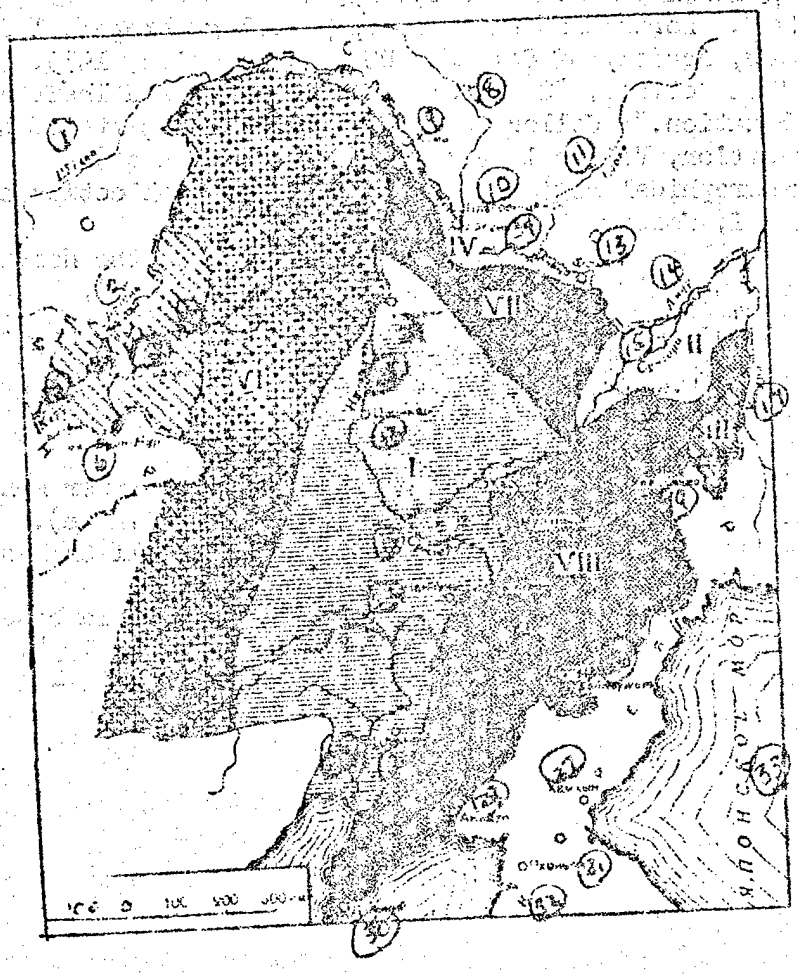


Figure 1. Plan of the natural regions of North-Eastern China

I.- Manchurian plain; II - San-chiang lowland plain;
III.- North Han-hai lowland; IV - Priamur plain;
V.- Barga; VI - Greater Khingan; VII - Lesser Khingan;
VIII - Eastern Manchurian mountains.

Legend to Figure 1.

1. Shilka River
2. Argun River
3. Lake Hudan
4. Hai-la-erh
5. Kerulen River
6. Pu-er Nor
7. Hsi-liao Ho
8. Zeya River
9. Huma
10. Blagoveshchensk
11. Bureya River
12. Chi-chi-ha-er
13. Fo-shan
14. Amur River
15. Sungari River
16. Chia-mu-ssu
17. Ussuri River
18. Harbin
19. Lake Khanka
20. Ma-tan-chiang
21. Hsi-liao Ho
22. Ch'ang-ch'un
23. Kirin
24. Mukden
25. Liao Ho
26. Pai-t'ou Shan
27. Ham-hung
28. Antung
29. Nung-chiang
30. Dairen
31. Peiping
32. Korea
33. Sea of Japan
34. Aigun
35. Nung Chiang River

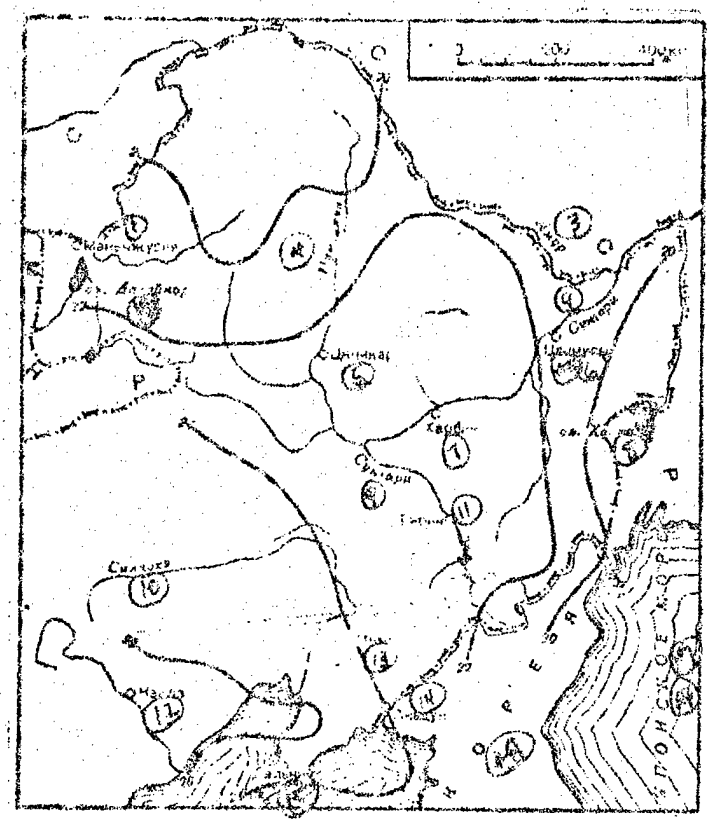


Figure 2. Isotherms of July (Centigrade) in North-Eastern China (according to Yang Jen-chang, 1950).

Legend:

1. Manchuria
2. Lake Hu-lun
3. Amur River
4. Nonni River
5. Chi-chi-ha-er
6. Chia-mu-ssu
7. Harbin
8. Lake Khanka
9. Sungari River
10. Hsi-liao Ho
11. Kirin
12. Cheng-te
13. Mukden
14. Antung
15. Dairen
16. Lake Dalainor
17. Sea of Japan
18. Korea

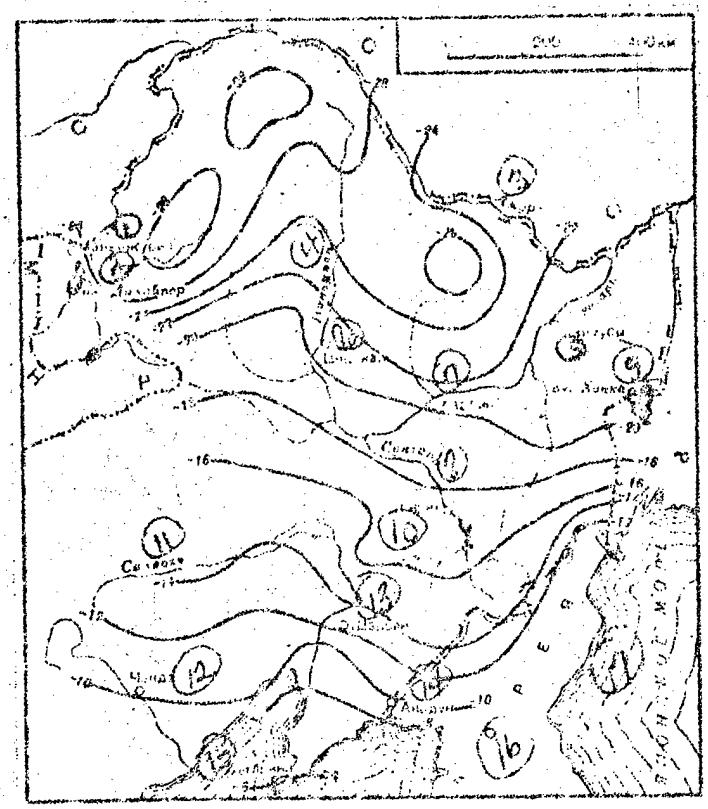


Figure 3. Isotherms of January (Centigrade) in North-Eastern China (according to Yang Jen-chang, 1950) (same map)

Legend:

1. Manchuria
2. Lake Hu-lun
3. Amur River
4. Nonni River
5. Chia-mu-ssu
6. Chi-chi-ha-er
7. Harbin
8. Sungari River
9. Lake Khanka
10. Kirin
11. Hsi-liao Ho
12. Ch'eng-te
13. Mukden
14. Antung
15. Dairen
16. Korea
17. Japan Sea

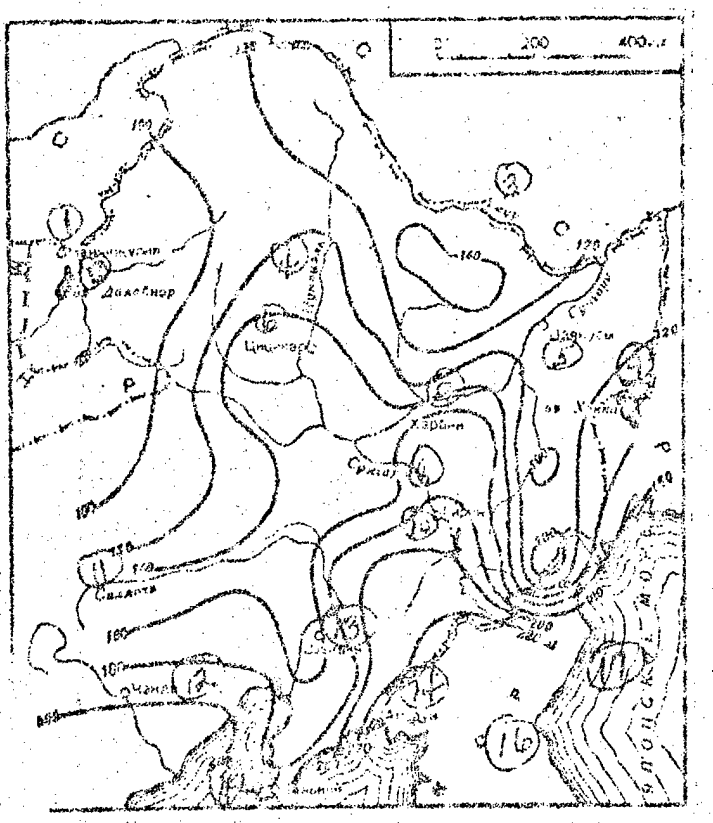


Figure 4. Isohyet for July (in mm) in North-Eastern China (according to Yang Jen-chang, 1950)

Legend:

1. Manchuria
2. Lake Hu-lun
3. Amur River
4. Nonni River
5. Chia-mu-ssu
6. Chi-chi-ha-er
7. Harbin
8. Sungari River
9. Lake Khanka
10. Kirin
11. Hsi-liao Ho
12. Ch'eng-te
13. Mukden
14. Antung
15. Dairen
16. Korea
17. Japan Sea

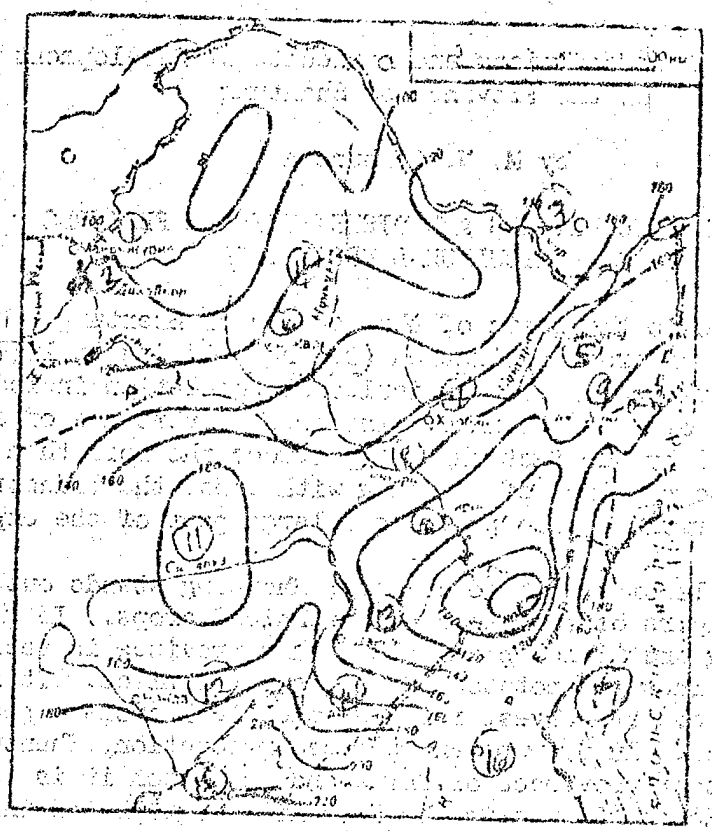


Figure 5. Length of the growing season (in days) in North-Eastern China (according to Yang Jen-chang, 1950)

Legend:

1. Manchuria
2. Lake Ha-lun
3. Amur River
4. Nonni River
5. Chia-mu-ssu
6. Chi-chi-ha-er
7. Harbin
8. Sungari River
9. Lake Khanka
10. Kirin
11. Hsi-liao Ho
12. Ch'eng-te
13. Mukden
14. Antung
15. Dairen
16. Korea
17. Japan Sea

II. Natural Conditions and Agricultural Development of the Province of Shantung

by M. N. Gorbunova

NATURAL CONDITIONS AND DISTRIBUTIONAL FEATURES OF AGRICULTURAL PRODUCTION

Agriculture is the basis of the economy of Shantung. More than half of the value of gross production (Druzhba, 17 August 1957, 1956 data) is in agriculture and the agricultural population includes 90% of the population of this province. The great importance of agriculture is determined by the fact that it provides the more than 50 million people of the province of Shantung with food; the industry - agricultural raw materials - also provides a large part of the export products.

In the scale of the whole country, Shantung stands out as one of the main producers of many food and technical crops. In wheat, soybean, kaoliang and millet production, this province is second in the country, and in sweet potatoes it holds first place. It is known for its high indices of harvest for many technical crops - peanuts, cotton and tobacco. In peanuts and tobacco production, Shantung surpasses all the other provinces of China and in cotton it is second to the province of Hopeh (Course in the Economic Geography of China, 1958). Shantung also produces a goodly amount of animal raw materials (bristle, down and plumes) and is known throughout the whole country for its fruit, silk and fish production.

The natural conditions of Shantung province are characterized by a succession of wide plains and low mountainous regions, excellent development of fertile, alluvial soils, comparatively high summer temperatures and a long period of sunshine which encourages the development of many different branches of agriculture.

Shantung is situated along the lower reaches of the Yellow River and is one of the northern coastal provinces of China. A small part of the territory of this province (153.3 thousand square kilometers) is occupied by the ancient Shantung mountains. Adjoining these mountains from the west is the large section of the Northern-Chinese plain, the low-mountainous Chiao-tung peninsula and many small coastal islands. Typical of the surface of this territory is the small area of mountains which make up 3/5 of the total area of this province. They are situated in the central part of the province and occupy almost the whole Chiao-tung peninsula. The mountains are composed mainly of ancient rock beds from archaic times. They are typified by low altitudes and dismemberment. (The high point of the province of Shantung is the T'ai Mountain which reaches an absolute height of 1545 meters.) The highest mountains in the central part of the province have average absolute heights of 400 meters and the

mountains of the peninsula have heights averaging 200 meters. This allows for fairly intensive economic exploitation of this territory. On the gentler slopes, fruit trees are planted and terraced fields are laid out. Terracing is frequently used in the northern and western foothills of the Shantung mountains where the comparatively complex river system provides the fields with an adequate supply of water. The Shantung mountains are almost completely unforested (only 7% of the territory of this province is forested) and a large part of this territory lacks even a grass covering which is the reason for the extensive river erosion and wash-away of soil. In connection with this, exploitation of the mountains for crop cultivation and animal raising is limited and livestock raising in Shantung like everywhere else in Eastern China, is based on surplus agricultural production. Inadequate pastureland is the reason for another peculiarity of animal raising in this area - the preferred breeding of big cattle which are kept almost year-round in stalls, the development of hog raising and the relative unimportance of sheep and goat raising.

The plains, large areas of which are to be found only in the western part of Shantung, are the main crop growing regions. This land, which encompasses the Shantung mountains in a kind of half-circle, and comes out at Po Hai Bay and the Yellow Sea, is a continuation of the North-Chinese plain, which is formed from the alluvion of the Yellow River. Only in a few places is the even surface of these plains broken by rises and they are almost entirely under cultivation. The main pasture lands are concentrated in this area; the total pasture land in 1956 consisted of 9300 thousand hectares, more than half of the whole territory of this province (61%).

The climatic conditions of the province of Shantung, which is situated between the 34 and 38° parallels of latitude, are characterized by a moderately cold and dry winter and a hot, moderately damp summer. The monsoon atmosphere circulation and resultant change in the air masses, which cause changes in weather, have a decisive influence on the climate of Shantung as well as the other coastal regions of China. The clear, dry winter days are associated with cold air masses, which come from the north and the north-west, from Siberia. The rainy, damp summer weather is caused by air masses coming to Shantung from the south-east, from the area of the Pacific Ocean. The eastern regions of Shantung have a milder and more humid climate while the climate of the western regions is dryer and more continental.

In the central part of the province, the average temperatures in the coldest month - January - are -2.5, -3° and in the hottest month - July, 27-29°. On the peninsula, the average January temperature is around -1.5°, and the average July temperature is 24°. (Climatic Atlas of China, 1953). Thus, the annual fluctuation in temperatures is greater in the western part of the province where it is 30° and more than on the coast (25°). Daily temperature fluctuations are also great: on the plains they are 10-14°, on the coast 10-12°.

(Lo K'ai-fu, Chou T'ing-ju and others, 1957). In the western section it gets warm earlier and the spring plowing, sowing and harvesting is carried out from 15 to 20 days earlier than in the eastern section. The comparatively high winter temperatures benefits winter grain crops which do well through the Shantung winter in the absence of snow.

The period of above-freezing temperatures lasts on an average of 250 days which allows for three harvests every two years on the drier fields or five harvests per three years and even two harvests in one year on the well-watered fields. But sometimes in the spring and autumn, there is a sharp fall in temperature due to the invasion of cold arctic air masses. Early-autumn and late-spring frosts, which shorten the vegetational period, are harmful to the crops and cause a great deal of damage to agriculture.

According to the average annual amount of precipitation which is 650 mm, almost the whole of Shantung, with the exception of the small south-eastern coastal belt, belongs to the dry temperate zone. The plain regions in the north-west of the province are the driest areas; the annual precipitation here is no more than 500 mm. Inadequate natural moisture, which is particularly noticeable on the plains, the principal agricultural areas, is compensated for to a large extent by artificial irrigation.

All of Shantung, like most of China, is marked by the irregularity of the rainfall over the year. Most of the rainfall, around 75% of the annual amount, occurs during the three summer months, July and August being the most rainy months when the rainfall is around 150-200 mm.; the rain usually falls over a protracted period in a drizzled form. Maximum precipitation in the summer, which coincides with the period of vegetation, is extremely beneficial to plants and crops. However the monsoon-type precipitation has its negative aspects. The abundant summer rains instigate a rise in the water level on the rivers which used to cause flooding and huge damages to the cropland. Besides which, the winter-spring seasons, when the agricultural crops are developing, has the lowest amount of precipitation (in the north-western part of Shantung only 15-17% of the annual precipitation falls from December through May, and on the coast only 16-20%). The inadequate precipitation in the spring, the sharp rise in temperatures and the dryness of the air leads to still another natural catastrophe - spring drought. This also causes serious damage to agriculture. This region is also characterized by the great fluctuation in the amount of precipitation from year to year which averages less than 25% of the average annual amount. In the city of Chi'nan, for instance, the average annual precipitation is 632 mm (based on observations from 1916 through 1953 - by the hydro-meteorological station in the city of Tszinan') but a maximum of 1021 mm which is 61% more than the average amount has been recorded, and a minimal amount of 348 mm which is 45% less than the average amount has been recorded.

The soil covering of Shantung is fairly uniform. Two basic genetic types of soil are to be found here: light-brown soils which make up 2/3 of the area of the province and brown forest soils. The light-brown soils are to be found on the plains and in the foothills. They are quite fertile and suitable for growing various types of heat-loving crops. Agriculture development in the regions where the soils are light-brown has been aided by the well-developed river network, especially in the foothills. When the working and watering of these lands is performed properly, two harvests can be gathered per year, if most of the crops have a good yielding capacity.

The light-brown soils are to be found on the new alluvial and proluvial deposits. They are usually characterized by a neutral or slightly alkaline reaction, a light-brown color, and a large accumulation of humus and by high carbonization and clay formation in the whole soil composition. The soils are saturated with Ca^{++} and Mg^{++} and are not salty. However under the influence of prolonged agricultural cultivation, the original properties of the light-brown soils undergo a radical change. Their natural granular-crumbly structure is alternated and the amount of humus and nutritive properties is decreased, which lowers their fertility and the harvest yield of agricultural crops. In order to increase the fertility of the light-brown soils, modern agricultural methods have been introduced all over Shandun since 1949 including mechanized labor, improved methods of working the soils, proper rotation of crops with leguminous grass and systematic organic and mineral fertilization.

Within the territory of Shantung, there are three separate sub-types of light-brown soils: 1) light-brown primitive carbonated soils; 2) light-brown, lixiviated soils and 3) typical light-brown soils (Lo K'ai-fu, Chou T'ing-ju, and others, 1957).

The most interesting of these are the light-brown primitive carbonated soils, because they make up the basic mass of arable land in the province. Almost the whole territory of the North Shantung and West Shantung plains is covered by these soils. The typical characteristics of light-brown soils are only superficially apparent in these soils because they were formed comparatively recently. They have a light-brown color, a well-defined cloddy-crumbly structure, and a uniform mechanical composition with a predominance of fine sandy and coarse sandy particles which are saturated with Ca^{++} and Mg^{++} and are not salty. Almost the whole territory covered by these soils, with the exception of small groves near the villages and around the cemeteries, are plowed and sown to crops.

The light-brown lixiviated soils are to be found on the foothill plains and also in the hilly regions of the Tszyaodun peninsula. They closely resemble the light-brown primitive soils but because of the high level of moisturization, their carbonate range is considerable decreased. The marl, sandy soils of this sub-type are very vigorous and usually contain no lime; they are especially good for

growing sweet potatoes and peanuts. In the area where the soil is of the light-brown lixiviated type, the natural vegetation is better preserved than on the plains where the soil is of the light-brown primitive type. The main types of vegetation here are various kinds of oak, Mongolian linden, Chinese ash, small-leaf maple, kozhevennaya skumpiya, Eastern thuya, and a variety of bushes - gledichiya, obvoynik, buck-thorn, and lespedetsa (Hou Hsueh-yu, et. al., 1957).

Typical light-brown soils are noted for their well-developed profile and well-defined signs of clay formation. They are not very common and are to be found in the part of the Hsiao-ching Ho plain which lies along the Chi-nan to Tsingtao Railroad. These soils are used for growing grain crops and tobacco.

The brown forest soil, in its various forms, is found in the mountains and hilly regions of the province. These soils have an acid reaction, a granular structure and have a low percentage of humus in their whole profile; they contain a small quantity of organic properties. The region where these soils are most highly developed, is the main forest area of Shantung. Both coniferous trees (dark-colored pine, Chinese pine and T'ung-po-er-k pine) and broad leaved varieties (liao-tung oak, jagged oak, cork-oak, Amur linden and leaf-bearing ash) grow on these soils. These soils are also extensively used for crop cultivating, for livestock grazing and for tree planting. In the sections where the relief is more even and the soil layer is deeper, the main agricultural crops are wheat, corn and Gaolyan. At the foot of the mountains and on the mountain slopes, fruit trees are planted including apple, pear, plum, walnut, Chinese chestnut and others. In the upper sections of the mountains, where the soil covering is very slight, only Arakhis, Batat and beans are cultivated.

Besides light-brown and brown forest type soils which are extensively used in the agricultural economy, there are other types of soil in Shantung which are of less economic value. To these soils belong to varying degrees, the salty soils which occupy more than 300 thousand hectares (Kung-jen Jih-pao, 23 July 1955) the sandy and meadow-swamp soils which are found in the flooded regions. In the mountains where the slopes are very steep and there has been a lot of erosion, very poor skeletal soils are to be found.

Like everywhere else in China, the agricultural economy of Shantung is very diversified. Both crop cultivation and animal raising, as well as various subsidiary branches, are developed here. (The main subsidiary branches are: gathering wild plants, hunting, fishing, primary processing of agricultural products, home industries for local needs and for export outside of the province.) In 1956, 76% of the value of agricultural production was in planting, 13% in subsidiary branches and only 11% in animal raising. The cultivation of Shantung specializes in grain (89% of the plough land is planted to grain), but technical crops and fruit crops also play an important role. Shantung differs from the north and south of China in its selection of crops;

the crops grown here reflect its intermediary position between the temperate and sub-tropical zones. Gaolyan, millet, and barley, which are native to North-eastern China, are grown here as well as winter wheat, cotton, bast crops and tobacco which are also grown in Southern China. Another feature of crop cultivation in Shantung is the high proportion of technical crops as compared with the north-eastern provinces; however these crops do not yet play an important role in the economy as they do in the southern part of the country. The most important of these are cotton and peanuts while in the south there is a wide development of tea shrubs, bast crops, olive trees and sugar cane.

Unlike the southern provinces of China, which are famous for their citrus production, Shantung is one of the main horticultural regions of the country for growing temperate zone fruits. Shantung fruits such as Yan-t'ai apples, lai-yang pears and Fu-shun cherries are known throughout the country. At the same time Shantung grows fruits also grown in the more southerly regions of the country like grapes, Khurma and peaches. Fruits which are grown only in Shantung are le-ling, ju-ju-pi Zhuzhuby (a type of Chinese date) and pomegranates with smooth stones, which are grown in the I Hsien.

Animal raising in Shantung is characterized by the high proportion of large cattle, pigs and domestic fowl. There is a predominance of work animals like big cattle, donkeys and mules. However unlike the other provinces of Northern China, in Shantung they make much greater use of cows not only for field work but also for meat.

The principal agricultural crops are wheat and soybeans which occupy 52.6% of all the sown area of the province (Economic Geography of Northern China, 1957). These crops provide the basis for the food balance of Shantung in the absence of coarse grain crops (like kaoliang, corn and millet), which are typical of north-eastern China and rice and sweet potatoes which are native to the southern section. More than 4 million hectares are sown to wheat, half this amount of land is sown to soybeans. Wheat is cultivated everywhere and is the main crop in most of the uyezds with the exception of the cotton regions and mountainous sections; more than 30% of the plough land is sown to wheat. The largest areas sown to wheat are located around the water-shed of the Yellow River and the Hsiao Ch'ing Ho where the soils are of the light-brown primitive type. In Shantung wheat is grown as a winter crop: it is planted in September and harvested in June after which soybeans (a summer crop) are planted on the same fields and harvested in the beginning of September. The wheat harvest averages 3.5 million tons. The regions planted to beans, which are the forerunners of wheat in the crop rotation, correspond territorially to the regions planted to wheat but they are more numerous in the south-western and southern sections of the province where more than 30% of the plough land is planted to them. The soybean harvest averages around 1.3 million tons. Besides these basic crops, coarse grains are also grown; the most important of which are kaoliang and millet and recently they have started to grow corn.

As was mentioned above, the technical crops are very important in the crop cultivation of Shantung. Although they still make up a small share of the sown area (around 10%), they furnish one fourth of the total value of crop output and make up an important part of Shantung exports. The main technical crops are corn, Arakhis, and tobacco; more than 95% of the area sown to technical crops is sown to these three varieties. The technical crops grew rapidly after the liberation of China. During the first five-year plan cotton, tobacco and Arakhis harvests increased almost two-fold.

The technical crops are distributed quite extensively over the territory of the province. On the plains where there are light-brown fertile soils, cotton, tobacco and bast grow well; in the hilly regions of the Chiao-tung peninsula where the climate is warm and moderate, peanuts and also cenafe grow well on marl, sandy soils. The main cotton region is in the Northern Shantung and Western Shantung plains with their alluvial soils. The area sown to this crop amounts to 800 thousand hectares. In Shantung high-quality fine and long-fiber cotton is grown which is used for manufacturing yarn No. 42-60. The cotton is planted between rows of winter wheat in April and May and is harvested in September (in the northern part of the peninsula it is harvested as late as October.)

Peanuts are the second most important technical crop of Shantung. This province produces more than one third of the whole peanut harvest of China and more than one fourth of all the area sown to this crop is concentrated in this province (Liu-Shih-ch'i, 1955). In Shantung there are three main regions where peanuts are grown: 1) the central section of the Shantung mountain group (Hsing-t'ai and Min-yang hsien) 2) the south-eastern coast of the Yellow Sea and 3) the eastern extreme of the Chiao-tung peninsula where the marl sand soils are planted to peanuts. Peanuts is planted in the spring (in the first ten days of May on the peninsula and in April in the central section; it is harvested in October and November. Shantung is the main peanut producing region in the country and is known for its high yield: an average of 18 centners per hectare and in some places 30-40 and even 80 centners per hectare.

Tobacco, which places third in importance of the technical crops of Shantung, is sown over an area of 40 thousand hectares; around six thousand tons are harvested. The main region of its cultivation is the area around the central part of the Chi-nan to Tsingtao railroad, the main tobacco-growing center is the town of Wei-fan. Tobacco is one of the most labor-demanding crops; it is planted in seeds and cultivated in rotation with wheat on irrigated ground. (See Map Insert)

The diversity of the natural conditions of this small territory has led to localization and specialization in various regions. Shantung can be divided into three main sections according to economic specialization and direction of development: 1) the region of the western plains, 2) the central mountain region and 3) the Chiao-tung low mountainous region. All of these are agricultural regions but the relation of crop cultivation to animal husbandry varies from one region to another; they are also distinguished according to the selection of agricultural crops and the type of livestock.

The region of the western plains occupies the most arable and habitable territory in the north- and wouth-western part of the province, adjoining the Shantung mountain group. Here the climate is warm and dry (the average July temperature is 27-29°); the amount of precipitation is 500 mm annually which falls mainly during the summer. Fertile light-brown primitive soils are widely distributed in this region and the soil cover is very good. Unlike the other regions, irrigation is well-developed here and this, combined with careful working of the land, and a large amount of fertilization, has made it possible to bring in large harvests.

This region specializes in wheat, cotton and soybean production. It is the main grain-cotton producing region where more than 75% of the cotton crop is concentrated and around 90% of the wheat crop of Shantung. Kaoliang, millet, corn and tobacco are also grown here. Fruits and vegetables are also grown here including dates, peaches and pears and various kinds of melons. In animal husbandry the breeding of large cattle which are kept almost the year-round in pens is prevalent along with hog raising. Poultry farming is also engaged in, particularly water fowl.

In this region there are large stretches of salty lands along the coast of Po Hai Bay and the flooded belt of the plains around the lakes. Therefore, besides the struggle for good harvests which is the foremost task for all the regions, the further development of agriculture here is closely tied to the agriculture assimilation of these lands.

The central mountain region lies in the Shantung mountain chain which is located at the center of the central half of Shantung. The mountains, was was mentioned earlier, have an average elevation of 400 meters above sea level and certain peaks are as high as 1000 meters; the foothills have an average elevation of less than 350 meters.

The moist warm monsoon winds which come from the ocean are retained by the Shantung mountains where the annual rainfall is from 700 to 1000 mm or almost twice as much as in the other regions. The soils here are of the brown forest type with varying mechanical composition depending on the bed rock. The warm weather and abundant rainfall have encouraged crop cultivation and fruit growing on most of these soils. Three harvests every two years are gathered on these soils with a fairly high yielding capacity.

Water erosion does a lot of damage to agriculture in this region. The erosion is encouraged by the large amount of rain, the torrential way in which it falls and the almost total lack of natural vegetation in this area. Water torrents not only carry away the upper fertile layer of the soil which leads to the formation of skeletal poor soils so that the bed rock is uncovered (this occurrence is typical of the T'ai Shan range) but these torrents also form wide, deep gullies. The soil washaway is very great in the T'ai Shan and Lu Shan ranges. The common occurrence of plane and linear erosion in this region has led to a decrease in the amount of arable land and has lowered the soil fertility; it has also lowered the level of sub-soil waters which limits the water supply for the population and the livestock watering-places.

The mountainous relief and intensive erosion of this region complicates the introduction of agriculture into this region; as compared with the other sections of Shantung, it is less developed from an economic standpoint. Crop cultivation here is not very marketable and animal husbandry, even though it plays a more important role than in the other regions, has also not developed very far because of the stoniness of the pasture land and the dryness which is caused by many lime deposits. This region is not self-sufficient and imports grain from neighboring regions.

The main crops here are coarse grain crops, millet and kaoliang, but on the scale of the over-all province, the region is distinguished for its production of sweet potatoes and peanuts, which are mainly concentrated in the south-eastern coastal area along the Yellow Sea. The other technical crops are not very common here. Fruit growing is well-developed in this region, the principal fruits being khurmy and hawthorn fruits. Characteristic of the animal husbandry is the prevalence of small cattle, sheep and goats. In the future, a good deal of attention will be devoted to improving the poor lands and reforestration in the Central mountain region.

An extension of the land under high-yielding crops, particularly corn, is very important.

The Chiao-tung low mountainous region includes the peninsular territory of Shantung to the east of the Chiao Ho. This is the smallest region (17.4% of the whole area of the province). It has however been subjected to a many-faceted development because of the diversity of natural conditions. Along with crop cultivation which is characterized by a good deal of selectivity in the crops, the fruit growing, silk producing and livestock raising branches of the economy as well as fishing and other subsidiary industries are well-developed.

The greater part of this region is covered with low mountains (up to 300 meters above sea level). Plains lie along the sea coast and along the river valleys, as a whole they occupy a small part of the territory and they are not very workable - the average arable land

per person here is only 0.16 hectare. The climate is warm and damp, the annual rainfall is 700 mm and more. In the low mountainous regions, the soils are mainly of the brown forest type; on the plains they are light-brown highly lixiviated soils.

This region specializes in the production of grain crops, sweet potatoes and peanuts which ressembles the preceding region but grain crops are more important here (they occupy around 50% of the plough land) and animal husbandry is less well-developed than in the previous region. The main grain crop is wheat, then corn and soybeans but the main agricultural crops, for which this region is noted on the scale of the whole province, are sweet potatoes and peanuts. More than one third of the total area planted to these crops is concentrated in this region and around half of the harvest of these groups is gathered here. Most of the crops are sown around the plains where the soils are quite fertile and sandy. One harvest of peanuts and sweet potatoes or two harvests of wheat and corn are gathered per year, or three harvests of corn, millet, wheat and soybeans every two years.

This region is known for its production of apples, pears and grapes. The apple harvest is 90% of the harvest of the whole province - pears, 20% and grapes - 30%. Silk-worm breeding is also practiced here, mainly oak silk-worms (K'un-shan, Wen-teng, Mou-p'in, and K'ung-yu hsien. The production of oak silk-worm cocoons amounts to 20% of the production of the whole province. In the animal husbandry branch of agriculture, hog raising is most highly developed, especially hog breeding which provides bristle for export. One fourth of the whole hog stock of the province is concentrated in this region.

The most common beast of burden is the donkey, to a lesser degree, the cow.

Along the coast, fishing and cultivation of sea algae is practiced. The main kinds of fish are gorbylevye, volosokhvost, mackerel and cod. Shrimp are also caught here; Shantung is known for its shrimp catch in the other coastal provinces of China and also for its crabs, crayfish, holothurians and shell-fish.

THE MAIN PROBLEMS OF POST-WAR AGRICULTURAL DEVELOPMENT

After the liberation of China and the successful completion of cooperization (at the end of 1956 in Shantung 95% of the peasants' holdings had been turned into cooperatives, of which 75% consisted of cooperatives of the higher type - "Druzhba" 14 November 1956), the scale of agricultural development in Shantung began to rise. The harvests of food and technical crops increase from year to year and their yielding capacity is also on the increase. In 1948 the harvest of food crops was 7.9 million tons, raw cotton - 61.6 thousand tons, peanuts - 317 thousand tons. In 1957 the production of food crops had increased to 15.2 million tons, raw cotton - to 270 thousand tons and sweet potatoes - to 1385.5 thousand tons. (The Economic Development of the

Peoples' Democratic Countries of Asia, 1957). The yielding capacity of grain crops increased from 9.3 centners per hectare in 1949 to 18 centners per hectare in 1955; cotton from 1.5 to 5.7 centners per hectare (Jen-min Jih-pao - 29 Sept. 1956), tobacco from 7.5 to 16.4 centners per hectare and peanuts to 18 centners per hectare.

In the second five-year plan (1958-1962) agriculture is developing on an even larger scale. In this respect, 1958 is a very good example; there was a much larger harvest of grain crops and cotton that year than in the preceding year. This harvest fulfills the basic nutritional needs of the province.

The widely developing movement towards the establishment of peoples' communes has played an important role in increasing agricultural production and in further economic development.

A satisfactory solution of the food problems in Shantung is complicated by the following circumstances: this province is not very large and has a dense population. It is known that this province is only surpassed by Szechwan in the number of its inhabitants (51.7 million people) while in area (153.3 thousand square kilometers) it is one of the smallest provinces in China. The density of the population (averaging 340 people per square kilometer) exceeds the average population density of China by more than five times while the amount of arable land is small (9.3 million hectares); this has conditioned an extremely efficient exploitation of the land and the amount of ploughed land in Shantung (61%) exceeds all the other provinces of the country. However, despite the high level of agricultural assimilation of its territory, Shantung is marked by the small degree of accessibility of its plough land to the peasant population on (around 19 hectares for every 100 people is being used for agriculture, which is less than average for the country as a whole. Therefore the importance of increasing the land resources, which is important to the whole country and to all regions with a clearly defined agrarian economy, assumes an added significance in Shantung.

Usually in order to increase the arable land one must make use of virgin and fallow lands. However in Shantung this possibility is extremely limited because there are very limited reserves of virgin land here; the total area of virgin land is a little more than 0.3 million hectares. In connection with this and also because of the low qualitative condition of these lands, the job of drawing them into the agricultural turn-over is not being performed on as wide a scale as it is in the western and north-eastern regions of the country. This is confirmed by the extremely slow growth of the arable reserves in Shantung.

From 1949 through 1957, the growth of arable area was only 11%; this growth came about not only through virgin land assimilation but also to a large extent by liquidating the peasant properties which existed before the liberation.

The assimilation of virgin and fallow lands in Shantung is conditioned by the natural conditions of this territory. The main feature of the Shantung virgin lands is their saltiness, the average content of mineral salts dissolved in the water is 0.5-5%.

The salty lands lie near the plain sections and have salty sub-soil water (1.5-2.5) m) near the surface. The largest mass of these lands are situated in the coastal section; in the other regions they are found in certain spots along the rivers or near the lakes.

The type and degree of saltiness and also the reasons for the saltiness of these soils differ in the various sections of Shantung. Along the banks of the bays of Po Hai and Lai-chou, the salting process is connected with the activity of ocean tides while in the lake region in the western section of the province and along the banks of the lower reaches of the Yellow River, the I Ho and the Shu Ho, it is due to poor drainage conditions. On the sea coast, chloric salting prevails, in the interior - sulfa-chloric salting (Hsiung I, 1956). For purposes of assimilation the most interesting of these lands are the coastal salty lands which make up the major part of the salted lands of Shantung. They lie near the low flat sections and extend along the coast in a narrow but continuous belt from the borders of the province in the north to the mouth of the Wei Ho in the south. The largest areas of salted lands are found in U-ti, Pin, Li-chin, and Chan-hua hsien north of the Yellow River. Characteristic of these regions is a superficial and continuous salting of the soils with a low percentage of salt content.

Depending on the intensity of evaporation and the amount of precipitation, the accumulation of salts in one section changes. Thus during the rainy season which occur in July and August, the salts on the top layer move lower down and on the surface the salting appears to be diminished. During the dry season, especially in the spring, when evaporation is very great, there is a rise in the salty sub-soil waters and the accumulation of salts in the upper layers. Besides this, the soil sometimes is covered with a white coating over large areas and in some places, a salty crust is formed which prohibits crop cultivation. By studying this periodicity, the local peasants have worked out special ways of working the soils and of storing up fresh water in advance before the rainy season. The concentrated character of the precipitation, and the large amount of it (around 500 mm) makes it easier for the peasants to do their job.

The plants which grow on the salty lands play a large part in decreasing the evaporation on the surface by preventing the salt accumulation in the soil. The height and thickness of the grass covering depends on seasonal change in the salt content. The most common plants growing on salty lands are the salt-marsh sveda, the coastal salt-marsh plant, the grassy soleros, Mongolian viper's grass, two-colored Gvozdika and several types of wormwood. They grow close to the earth, have a curved stem and a badly developed root system. The salt-

marsh sveda is better adapted to the more salty soils than the salt-marsh coastal plant and in sections with a comparatively low content of salt (around 1%) they are replaced by other types, chiefly by Chinese miskantus which grows in the dry section and karka reed which prefers the damper places (Hsi cheng-fan, 1953). These plants grow on soils with a salt content equal to those on which agricultural crops could be grown. Therefore the occurrence of these types of plants is taken as a sign by the local peasants that the soils can be used for cultivation. However the natural process of desalting the soils proceeds very slowly and in order to speed up this process, man must interfere.

Assimilation of the coastal salty lands was put into effect on a large scale after 1949. These operations are only being carried out in the sections with only slight saltiness and where the soil structure is not very broken up. Assimilation of seriously salted soils (with a salt content of up to 5%) demands complicated measures of improvement and would only be possible if agriculture were mechanized to a much greater extent.

The main method of improving salty soils, which is based on practical experience and on Soviet science, is a combination of interrelated measures. One of these is directed at ridding the soil of an excess amount of easily dissolved sodic salts and lowering the level of salty sub-soil waters which stand very close to the surface; other measures are directed at improving the physical properties of the soil. In the fight against salification the most positive results are achieved by employing a range of measures but, depending upon local conditions and the degree and character of the salting, the methods by which these measures are carried out, should vary. While it is sufficient when dealing with lightly salted soils to apply correct agrotechnical methods of working the land, for more salty soils the most essential operation is establishing drainage by means of which some of the salty sub-soil water can drain off. Lowering the level of these waters and washing the soil will depend upon local water norms. The soil is usually washed off in the latter part of November when the level of sub-soil waters is lowered, when evaporation on the surface is not very great, and when large stores of fresh water has been built up in the reservoirs after the summer rains.

Assimilation of virgin land in Shantung is mainly carried out by the goskhoz (state farms) which have the advantage of organized labor forces and modern agro-technology. The salty soils are used for cotton and rice cultivation in rotation with other crops.

No less important than the assimilation of virgin land are measures to improve the sandy soils and combat rocky soils. The formation of sandy soils has to do with the action of the rivers which break through the protective dams along their banks during the flood season and flow over the once fertile fields turning them into sandy wastes. Particularly large stretches of sandy soils are located along the lower course of the Yellow River. These soils have a very low capacity for

retaining water, humus does not accumulate in them and they are left with almost no structure or without structure. The yielding capacity of agricultural crops on these soils is very low; for example, in the Hun-feng cooperative which is located in Chia-ho volost, Shou-kuan Hsien, the harvest of grain crops on sandy soils was only 3-4 centners per hectare and even, in the most fruitful years, did not exceed 5.2 centners per hectare. Nevertheless the experience of this cooperative has shown that after improvements were made on these soils and proper agro-technical practices were observed, the yielding capacity of grain crops on these soils increased rapidly to 35.3 centners per hectare (Experiment in Improving the Soils in Shantung, 1957).

There are large reserves of unexploited land in the mountainous regions of Shantung. This land is very eroded and comprises more than 25% of the whole area of the province. (Jen-min Jih-pao", 24 February 1958). Frequent heavy downpours which occur in these regions, where the slopes are naked, lead to the formation of seley as a result of which the arable lands become blocked with stones, the river beds overflow and the roads are washed away. As a result many areas of valuable land are not being exploited agriculturally. This reduces the plough land and lowers the production of grain and technical crops.

Therefore it is extremely important to the development of agriculture to combat soil erosion in the mountainous regions. In 1958 operations to prevent soil erosion were carried out over an area of around 400 thousand hectares. "Jen-min Jih-pao" 24 February, 1958). They consisted of organizational and agricultural measures particularly ploughing and planting across the slopes, which has been practiced for many years, the introduction of perennials, increasing winter crop sowing and field-protecting forestration. In the whole province more than 1.3 million hectares of mountain slopes and riverbank wastes are considered suitable for tree planting. At the conference of workers of the timber industry which took place in the beginning of 1958, it was decided to complete the tree-planting program in this province by 1960. Forest strips are being laid out on the water sheds, along the slopes of the ravines and gorges, along the banks of the rivers and lakes, around the ponds and reservoirs. The trees and bushes retain the moisture in the soil and prevent the soil from freezing. Among the various types of trees being planted are fast-growing poplar, birch, fir and among the various types of bushes - acacia and hazel-wood. Fruit trees and grape vines are also being planted on a large scale. In order to speed up reforestration in Shantung, an area of 1.5 thousand hectares has been planted to nurseries, in which several thousand seedlings are planted each year.

Thus, has been shown that in virtue of the natural conditions of the territory of Shantung and its dense population, the possibilities of increasing the agricultural production by means of extending the arable land resources is very limited. Therefore in order to resolve this problem, improvement measures and more efficient exploitation of

existing land resources, aimed at achieving maximum production from each unit of the land, assume the greatest importance.

The most effective results are achieved through ameliorative operations. In order to effect these measures, each year large expenditures, machines and construction materials are turned over. As compared with the pre-war period, the area of improved lands in Shantung has increased from year to year since 1949.

The agricultural economy of Shantung suffers mainly from autumn floods and spring drought. Therefore these measures chiefly serve the purpose of combatting these natural catastrophes. During the early years after the liberation, most of the capital investments went into flood control. The largest irrigational improvements during this period were operations carried out to reform the systems of the I Ho and the Shu Ho which flowed through the south-eastern section of the province. These measures considerably reduced the flood threat, and made it possible to irrigate large areas of land and improve the navigational possibilities on these rivers. During the first and second five year plans, work was increased on widening the irrigated areas. At the Shantung conference which took place in January 1957, it was noted that development of the irrigation system and flood control are the principal tasks for further developing agriculture in this province.

Shantung, like in all of Northern China, bogarnoe culivation was prevalent, and irrigation played a very insignificant part. For example, the total area of irrigated lands in 1949 was less than 3% of all the arable land in the province (Economic Geography of Northern China, 1957). The main part of these lands are situated in the plain region which adjoins the northern and western foot hills of the Shantung mountain chain and on the cosst of the north-western part of the Chiao-tung peninsula. The largest proportion of irrigated lands in the whole area under tillage is in the Nin-yang, Fei-ch'en, Hen-t'ai, and Lin-chai villages in the central part of the province and in I and Huang hsien on the peninsula.

A special feature of irrigation in Shantung is the development of well-irrigation by means of which more than 90% of the irrigated lands of the province are irrigated. There are more than 2 million wells here (this province holds first place in the country for the number of its wells). There is also a large number of water pumps, water engines and other equipment. After the liberation, there was a universal drive to restore the old wells and build new ones and to increase the use of water-raising wheels. Besides well-type irrigation, there is also a certain amount of primitive, spontaneous irrigation particularly in the river valleys. Since 1949, the irrigated area has grown considerably and already in 1952 it made up 5% of the arable land. During the first and particularly the second five year plans, irrigational operations are being carried out on an even larger scale. Already in 1958, the irrigated area was supposed to have increased to almost 2 million hectares which is four times more than in 1952. ("Jen-min Jih-pao" 14 February 1958.)

Of great importance to the development of irrigation is the plan for reforming and exploiting the Yellow River which was proposed at the All-Chinese Assembly of Peoples' Representatives in the summer of 1955. According to this plan, the construction of large dams and reservoirs near Chi-nan and at the point where the Great Canal crosses the Yellow River, has been proposed as well as the creation of a region of irrigated lands to the north of the Yellow River and between the Yellow and Hsiao-ch'ing Rivers. According to this plan, by 1962 the irrigated area in Shantung will have increased by 468 thousand hectares (on the Complex Plan for Controlling the Yellow River..., 1955). Part of this huge plan was the construction of a water lock 89.6 meters long and 9 meters high in the village of Ta-yu-chan (100 km. from the mouth) which was completed at the end of 1956. As many as 26.6 thousand hectares have already been irrigated because of this construction. ("Druzhba" 19 December, 1956). By 1960 the area of irrigated lands in this region will have been extended to 230 thousand hectares. On October 1, 1958 the irrigational system of the Wei-shan Hydro-technical Complex was put into operation. This system irrigates 480 thousand hectares. After the completion of all the operations in this region, the area of irrigated lands will increase to 1.3 million hectares and the Wei-shan system will become one of the largest irrigational systems in China.

The development of irrigation in Shantung will make it possible to increase the number of harvests over the yearly cycle besides increasing the size of the harvests. As was mentioned above, in most of this province there exists a system of three harvests every two years of which the main crop is winter wheat and its forerunners - kaoliang and millet, which are planted in the spring, and also peanuts and corn.

In the summer, after the wheat has been harvested, the late crops are planted: soybeans and sometimes sweet potatoes, corn and peanuts. In the province as a whole in 1953, the average co-efficient of the yielding capacity was 1.4 which is higher than in the provinces of Hopeh and Shansi but lower than in Honan province. According to the "Basic Aspects of the Plan for Developing the Agricultural Economy of the CPR from 1956 to 1967" (1956) this co-efficient should increase by 1967 to around 1.6. The introduction and overall distribution of dual harvests is of great importance to Shantung, which experiences a lack of arable resources, and a very high level of productivity of cultivation. With the development of irrigation, the areas of repeated sowing will increase and the production of agricultural crops will grow rapidly.

On an equal plane with irrigational construction is agro-technical improvement in the task of increasing the yielding capacity of this province.

In the past agro-technology in Shantung was on a low level of development; the lack of work animals leads to low and irregular harvests. The main agricultural tool was the wooden plow. The sowing was

sometimes done by hand. Since the establishment of cooperatives, government farms and machine-tractor stations, agricultural technology has improved considerably. Tractors and modern plows have appeared on the fields of Shantung - including two-wheel, and single and double body plows which are manufactured right in the province. The number of seeders, cultivators, reapers and other equipment is being increased.

The ploughing used to be done to a depth of only 10 cm. and occasionally to 15 cm. Under such a superficial method of ploughing, only relatively small land masses were profitably exploited, the development of root systems of the plants was impeded, the moisture content of the soil was lowered and as a result, the size and reliability of the harvests was lowered. Shallow ploughing had particularly disastrous results where the rainfall was inadequate, where the necessary store of water for subsequent plant feeding was not built up in the deeper uncultivated level of the ground. At present deep ploughing is being practiced universally as well as water storing and cultivation.

The deep plough land is tilled to a depth of from 0.5 to 1.5 meters. By the end of January 1958, deep ploughing and surface soil planning had been put into effect over an area of around one million hectares. ("Jen-min Jih-pao 28 January, 1958.) These measures contributed to the large harvest which was gathered in 1958. In the future these operations will be extended and deep ploughing will be introduced over an area of more than three million hectares. Deep ploughing is also very important on salty soils. Since 1954, deep ploughing and field planning have been introduced on salty soils over an area of 670 thousand hectares. Plans for the next 3-5 years provide for the introduction of these measures over an area of 4.6 million hectares. ("Jen-min Jih-pao")

Because of the not infrequent occurrences of frost during the early autumn and late spring, it is of great importance to sow the crops early and carry out the sowing operation at optimum times. In the regions where the soils are salty, it is important to correctly establish the times for sowing. The temperature of these soils is usually lower than the rest of the soils and late spring and early autumn sowing is therefore carried out in these regions. On the Liang-ch'un goskhoz (state farm), for example, spring sowing on salty soils is carried out from five to six days later and in the autumn from 10 to 15 days earlier than on the non-salty soils. When the seeds are sowed on comparatively warm soil, the sprouts develop normally and the harmful action of the salts is lessened. The achievements of Soviet agro-technology are now being introduced including: (square-cluster) planting of corn, thick sowing of cotton and grain crops. An average of 90-130 square-hectares of wheat is now being sown per hectare instead of the previous 60-70 square-hectares. A more equalized distribution of seeding along the bottom of the furrow is being attempted. Thus the sprouts are coming up closer together and the crops are not as spread out which is very important, particularly in view of the strong winds which prevail in this province.

To increase the harvest in Shantung, efforts are being made to increase the amount of fertilization and improve methods of application. Formerly the basic types of fertilizer were compost, manure, cotton-cake, ashes and various garbage and wastes. At the present time, along with organic fertilizers, mineral fertilizers are being used more extensively. Because of the prevalence of sour and neutral soils in Shantung, many nitrous fertilizers are being used. In the regions where the soils are of the brown forest type, lime is being applied and on the salty soils - gypsum. A good deal of attention is also being given to extending the area of crops under green fertilizers - lucerne, astragulus, and lyupina, which are usually ploughed under one month before the initial crop is planted. In recent years, the fields of Shantung have been fertilized with the left-overs of the fish-canning industries. This type of fertilizer, as experimental crops have shown, raises the yielding capacity of wheat, kaoliang, peanuts and corn by 20 to 30%. Sea fertilizers made from rachkov, oysters, and various shell-fish and crabs has also proved very effective (Experiment in Application and Use of fertilizers in Shantung, 1957).

Another important measure, which is being taken all over Shantung, is improved seed sowing and the introduction of high-quality seeds. In 1956, 80-90% of the total area sown to wheat and cotton was sown to assorted seeds. New sorts of wheat have been introduced because the local varience are poor. In I Shien, for example, the local wheats hung-t'u-t'ou, Hsi-mai and hsiao-pan-tang have a very weak stem and collapse immediately after ripening. The type of wheat found in Ch'an-shan Hsien at the Shen-li Ai-ko cooperative is called "Ch'in-pao-en"; it has a very low yielding capacity.

The type of high-quality wheat to be used is decided in strict accordance with the natural conditions of the locality. In this way not only is the harvest increased but crop resistance to poor climatic conditions is strengthened. Among the new sorts of wheat most universally in use in Shantung are "Yu-chi-mai;" "ta-ti pan-tang", "Pi-ma 4," pi-ma 1." Almost all of these types, with the exception of "ta-li pan-tang", can withstand yellow mould and produce large full grain and a high output of flour and do not demand much fertilization. Another important factor is the use of crops which ripen at different times on the fields of one cooperative as for instance "Pi-ma 4" and "Yu-chi-mai." By this means it is possible to get all the work done in spite of an inadequate labor force during the hot season of the summer harvests. An interesting operation of introducing new hybrid-seed corn is being carried out by the Shantung Scientific-Research Institute of Agriculture. By using mixed types of hybridization, new high-yielding types of seeds are being introduced here including "fan-cha 2," "pai-cha 1.", "hsi-cha 1," Hupeh ch'un-cha 1," and "hun-hsi-wan 1" which are used extensively on the fields of many provinces.

In planting soybeans on the plains which have soils based on loess, the best results are obtained by using the "p'in-ting-huang" and "na-man-ching" types of soybeans. Besides yielding a harvest two

to four times as large as that of the other types of seeds, these types have a whole series of advantages: they are drought-resistant, they yield fat beans, their seeds contain a lot of oil. The "p'in-ting-huang" type has a thick skin which protects it from blights. In the hilly regions where the soil cover is not very great, a short-stemmed soybean is used, and in the low flooded regions, the moisture-loving variety is planted. On salty soils the seeds of more salt-resistant plants are sown. With these types of seeds, the sprouts come up earlier and have a high co-efficient of germination (up to 90% as opposed to 60% when using the other seeds.)

Since the development of a cooperative economy in Shantung, the fight against plant diseases and field blights is being conducted more successfully. Among the most damaging agricultural pests is the locust, which has devastated large areas of crops. Formerly no attempt was made to fight these devastating onslaughts but now they are using airplanes for this purpose. In the summer of 1957, for instance, by dusting with poisonous chemicals from the air, most of the locusts were destroyed which had laid hold of an area of 60-120 thousand hectares ("Druzhba" 11 August 1957) in the north and western section of the province (the Lin-ching and Kuan-t'ao hsien). The main wheat pests in Shantung are the mole-cricket, the wheat mite, the wheat gnat and the mushroom growth which causes such diseases as sprout yellowing, wet brand and yellow rust. In order to prevent the rise of diseases on many cooperatives, for instance on the Shen-li Ai-ko cooperative, the seeds are treated in white-lime. In order to destroy the pests in the soils, chemical preparations are being used. The "666" preparation is very extensively used. This preparation also gives positive results in the fight against various kinds of pests which attack other agricultural crops.

An important means of increasing the grain harvest from a unit of area is increasing sowing of high yielding crops. Crop cultivation in Shantung, as was pointed out previously, specializes in the production of food crops. Among these, the most important are wheat, kaoliang, millet, corn, soybeans and sweet potatoes. Naturally all of these crops yield different harvests. The highest harvest is yielded by Batat (up to 112 centners per hectare), millet and corn; the lowest harvest yield comes from the soybean (7.5 centners per hectare) and kaoliang (11.2 centners per hectare). ("Kung-jen Jih-pao") 23 July 1955.) At the same time the largest areas of arable land, after wheat, is planted to these two last crops. According to data gathered in 1953, the area occupied by soybeans was 16.7% of the total area and kaoliang - 12.3% (Economic Geography of Northern China, 1957). Therefore, it was important to change the inter-relation of the sown area by increasing the proportion of high yielding crops. During the first five-year plan, the area under these crops was supposed to increase by 670 thousand hectares, including 267 thousand hectares under Batat.

("Kung-jen Jih-pao" 23 July, 1955). By extending the fields of high-yielding crops, not only will the production of food increase but the production of green and rich fodder, of which Shantung suffers a lack, will also be greater.

There are expensive plans for enlarging the area under corn, sweet potatoes and water rice. Rice is almost a new crop in Shantung. Formerly the rice fields occupied from 1 to 9% of the sown area of the province; it was only grown in a few ugezds. When irrigation has developed, it will be possible to greatly enlarge the area sown to rice because the climatic conditions of Shantung, and particularly the high temperatures (more than 22°) during five months of the year (from May through October) are very suitable to this crop. As far as its yielding capacity is concerned, rice is the most profitable crop. It's harvest yield is two to three times higher than that of the other grain crops. The area sown to rice up to 1957 was only 8.6 thousand hectares, while in 1958, it increased to more than fifteen times that amount and reached 133 thousand hectares. ("Jen-min Jih-pao" 14 February 1958). The main rice regions of Shantung are the lake plains, the inundated lowlands and the assimilated salty lands along the banks of Po Hai Bay.

The particular natural conditions of Shantung create a need for introducing many agro-technical and ameliorative measures in order to raise the agricultural economy of the province; these measures differ substantially depending upon local conditions. In the western plain region, where there is a lot of damage from drought and flooding, irrigational construction is of the first importance including construction of reservoirs, ponds, wells as well as improving the sandy soils, enlarging the arable land and introducing deep ploughing.

In order to assimilate the flooded and salted lands, which occupy a large part of this oblast, special measures must be taken. A drainage system must be built before this land can be made arable; moreover, in the regions where the soils are salty, washing the soils is very important and in the flooded regions - the construction of furrowed irrigation and terracing. The development of the agricultural economy in these regions calls for corresponding agro-technical measures - cultivation of moisture-loving crops (rice and kaoliang) on the inundated lowlands and salt-resistant crops (cotton and rice) in the regions where the soils are salty.

One of the prerequisites for developing agricultural production in the Central mountainous oblast is erosion control. In connection with this, it is very important to organize the territory of this region along rational lines: by properly distributing the fields on the slopes, introducing thick sowing of crops, winter sowing and grassy field crop rotation and also by means of forestration and field-protective belts for water and soil retention.

In the Chiao-tung foothill region, the harvest yield can be raised by combatting formation of ravines, developing terracing and improving the sandy soils and extending fruit tree planting.

BIBLIOGRAPHY

Geographic Atlas of the Chinese People's Republic - Shanghai, 1957 (in Chinese).

Climatic Atlas of China. Main Administration of Meteorology and the Institute of Geophysics - Peking, 1953 (in Chinese).

Course in the Economic Geography of China. Peking, 1958 (in Chinese).

Lo K'ai- Chou T'ing-ju and others. Materials on the physical Geography of Northern China. Issue 3, Peking, 1957a (in Chinese).

Lo K'ai-fu Chou T'ing-ju, and others. The Physical-geographical Regionalization of China. Collection of articles. Issue 1. Trans. from the Chinese. Moscow, 1957b.

Liu Shih-ch'i, Geography of Agriculture of China. Shanghai, 1955 (in Chinese).

On the Complex Plan for Governing the Yellow River and Exploiting Its Water Resources. Supplement to the magazine "People's China", 1955, No. 21.

Experiment to Improve the Soils of Shantung. Agricultural Administration of the Province of Shantung; Chi-nan 1957 (in Chinese).

Experiment in Accumulating and Applying Fertilization in Shantung. Agricultural Administration of the Province of Shantung; Chi-nan, 1957 (in Chinese).

Basic Situation of the Plan for Development of Agriculture in the CPR in 1956-1957. (Plan Proposal of the Politburo of the CC CPC - 23 January 1956) Moscow, 1956.

Economic Development of the Peoples' Democratic Countries of Asia (Survey for 1956) edited by M. I. Sladkovskiy and Yu. N. Kapelinskiy, Moscow, 1957.

Hsi Ch'eng-fan, Problem of Improving and Exploiting the Salt-marsh Wastes in the Coastal Regions of Shantung. Magazine "T'u-jang Hsueh-pao," 1953, Vol. 2, No. 2 (in Chinese).

Hsiung I. Regionalization of the Salty Soils of China "Pochvovedenie" 1956, No. 11

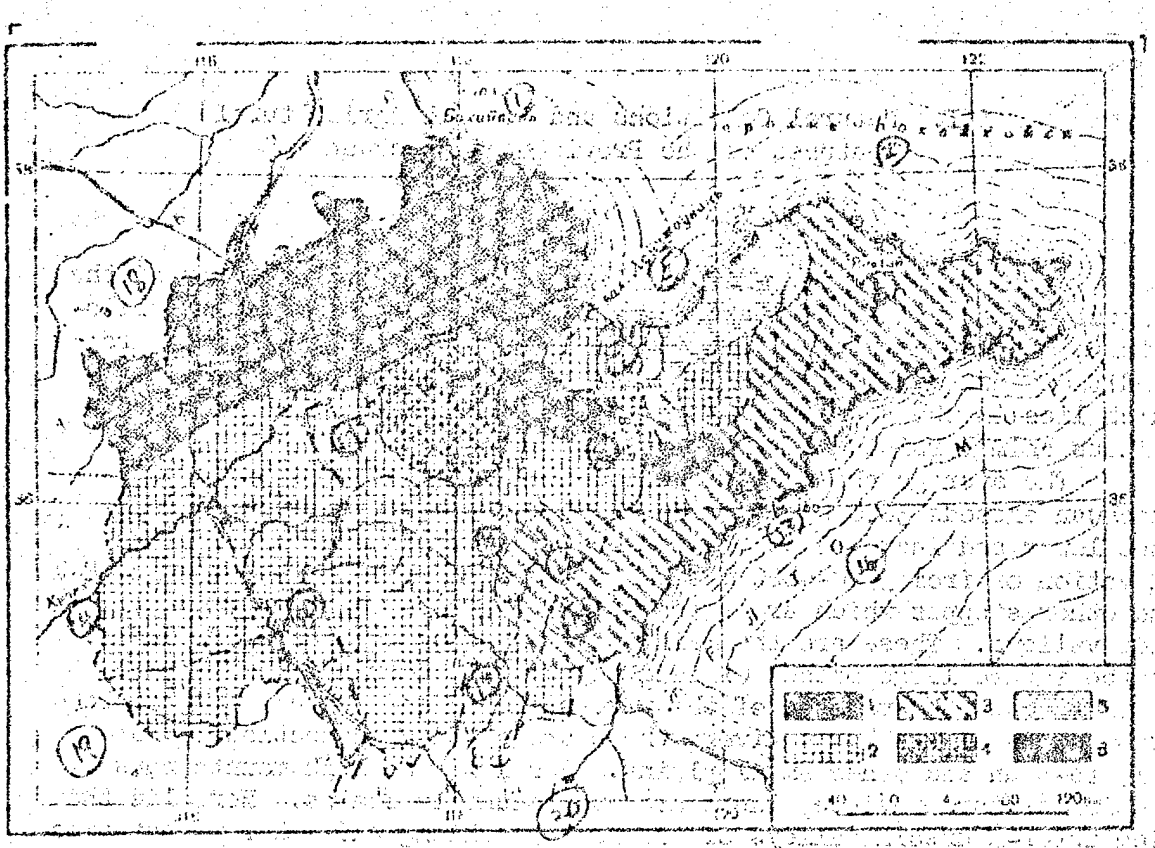
Hou Hsueh-yu, et. al., The Vegetational Covering of China and its Connection with the Basic Types of Soils. Magazine: T'u-jang Hsueh-pao, Vol. 2, No. 1, 1957 (in Chinese).

Tsou Pao-chuan. The Natural Features of Shantung, Magazine: "Ti-li," 1941, Vol. 1, No. 1 (in Chinese).

Shantung, BSE. Pub. 2, Vol 47, Moscow, 1957.

Economic Geography of China. Trans. from the Chinese. Preface and edit. by P. I. Glushakova and G. A. Sanshina, Moscow, 1957.

Economic Geography of Northern China. Edit. by Prof. Sun Chin-chih, Peking, 1957 (in Chinese).



MAP INSERT - Distribution of agricultural crops in Shantung Province. Regions with predominance of: 1. cotton and wheat; 2. wheat, other grain crops and soybeans; 3. peanuts and sweet potatoes; 4. millet and corn; 5. wheat and corn; 6. tobacco.

Legend:

1. Po Hai Bay
2. Po-Hai Sound
3. Lin-ching
4. Yellow River
5. Lai-chai-wan Bay
6. Yen-t'ai
7. Wei-fan
8. Wei Ho
9. [No item 9]
10. Chi-nin
11. I Ho
12. I-shui
13. Tsingtao
14. Lin-i
15. Shi Ho
16. Yellow Sea
17. Tsinan
18. Hopei Province
19. Honan Province
20. Kiangsu Province

III. Natural Conditions and Special Agricultural Features of the Province of Szechwan

by Ye. A. Afamas'evskiy

Szechwan Province, which is located on the upper reaches of the Yangtze River, occupies an area of more than 577 thousand square kilometers. It may be divided into two sections according to its natural conditions and agriculture: the eastern, crop cultivating section which lies in the so-called Szechwan basin and the western high mountainous animal raising section.

The average absolute elevation of the western section of Szechwan exceeds 3000 meters. In the south the elevations are somewhat lower and increase as one proceeds north. In the north, at an elevation of from 3500-4800 meters, lie the Chuv-ch'in, Shih-ch'iu, E-ke and other steppes which are transversed by rivers which flow quietly in wide valleys. These are the main animal raising regions of Szechwan. In the future large masses of land may be put under the plough here. Further south the valleys of the rivers deepen and dry up; around the tributaries of the large rivers there are cultivated sections - Kan-chi, Pa-t'an and other small plains. South of the high mountainous section of the province, there are huge mountain chains. Here lie the wide inter-mountain valleys of the Ya-lung Chiang and other tributaries of the Yangtze which are suitable for cultivating sub-tropical and tropical crops.

The eastern half of the province or the Szechwan basin is a closed hollow, the lowest in the southern section of the province. The territory of this hollow, without the surrounding mountains, occupies a little more than one third the area of the province (or around 200 thousand square kilometers), and almost all of its arable land is concentrated here. The surface of the inner section of the basin is divided up and cross cut by a thick net of valleys of ancient dried up rivers and existing rivers. The development of agriculture under this very hilly type of relief depends upon the gradual agricultural assimilation of the steep slopes. The largest relatively flat sections are situated in the southern section of the basin where the river valleys, which widen at this point, are covered with fields. There are almost no large plains in the Szechwan basin, with the exception of the Ch'eng-tu plain which is formed from the cones of the wash-away, which is left when the numerous rivers leave the steep north-western mountains. The widest section lies on the large wash-away cone of the Min Chiang. The surface of the plain which slopes down slightly to the south-east is very well-suited to spontaneous irrigation from the waters of the Min Chiang. This has contributed to the early agricultural assimilation of this plain. The proportion of land under cultivation on this plain is the highest in the province, and almost all of it is covered with rice fields.

In the Eastern Szechwan mountains which lie in the eastern section of the Szechwan basin between the Ch'iu Chiang and Yangtze Rivers, the large inter-mountain valleys are under cultivation as well as the low artificially terraced sections of the slopes and the u-shaped hollows in the higher sections of the mountains. The distribution of crops in the Eastern-Szechwan mountains has been determined to a large extent by geological conditions. In the valleys and on the slopes which are composed of sand deposits, rice fields prevail, while on the u-shaped hollows where the soils are strewn with lime deposits and do not retain the water, the main food crops have become the ones that do not need much water: potatoes, corn and buckwheat, the fields of which are planted to tung tree. The abundance of tung trees, especially in the high sections of the ranges, have contributed to these regions becoming the most economically developed mountainous regions. As a whole the Eastern Szechwan mountains have a small area of arable land because of their very steep slopes. Even less arable are the mountains surrounding the Szechwan valley. One exception is the south-western borderland of the basin where wide areas suitable for cultivation are to be found between the O-mei Shan Ta-liang Shan and Hsiao-liang Shan mountain chains.

Climatic conditions have greatly contributed to the development of crop cultivation in Szechwan. The climatologist Chang Pa'o-k'un (Chang P'ao-k'un, 1954) proposes the following climatic seasons, which do not correspond with the calendar seasons, based on average five day temperatures. The season with average five day temperatures lower than 10° Centigrade corresponds to the winter, from 10 to 22° to the spring and autumn and above 22° to the summer. If the year is divided up according to this method, spring in the basin begins at the very end of January and ends towards the middle of April, lasting 70 days; summer ends around the middle of September (lasting 95 days) autumn - towards the middle of December (lasting 95) and winter - towards the end of January (lasting 45 days). Thus the Szechwan summer lasts more than two times as long as the spring and three times as long as the winter.

The Ta-pa-shan and Toinling Shan cut off the cold northern winds from Central Asia. In Nankin the average annual invasion of cold air masses during the winter season is nineteen, in Sui-ning there are only twelve, besides which the occurrences of cold waves in the winter months (December - February) are very rare here. In connection with this, winter in the eastern half of Szechwan is warmer than in the provinces which lie both on the lower reaches of the Yangtze and somewhat farther south, and the climate of the Szechwan basin is milder and less continental. While the territories east of the Three Ravines, which are crossed by the Yangtze just before it leaves Szechwan, are suffering from cold waves, snow and icy winds, in the Szechwan basin, which is surrounded by mountain peaks, the fields of wheat are turning

green. There are no strong winds here. With the oncoming of winter in this basin, there is almost a complete lack of wind. Thanks to this particular climatic feature, the province of Szechwan has an almost complete monopoly on white bees-wax in China because the motley-winged insect, which provides this product, cannot withstand windy weather.

Despite the relatively high average monthly temperatures during the winter period, in the Szechwan basin freezing temperatures do occur. The period during which there could be frosts in the city of Ch'eng-tu, lasts for two months - from the end of November through the end of January. As you proceed south, this period is sharply reduced and in Sui-ning, which is situated near the center of the Fou Chiang, it is limited to a period of 25 days and in the city of Pei-p'o, which is north of Chungking, it is only 2 days long. Thus the above-freezing period in the Szechwan basin is very prolonged and exceeds not only any other region of the Yellow River basin but is also several days longer than in the regions along the lower and central reaches of the Yangtze. In the city of Ch'eng-tu the above-freezing period is 67 days longer and in Sui-ning, it is as much as 104 days longer than in Nankin.

Freezing temperatures in the Szechwan basin correspond to light frosts (up to -2° Centigrade) and do not represent a serious danger to agricultural crops. In this respect, the winter period in Szechwan is more suitable to crop cultivation than it is even in regions situated much farther south. Agricultural operations in the main cultivated region of the province are not interrupted during the whole four seasons of the year which makes it possible to gather annually up to three and more harvests.

The area in Szechwan where the vegetation is green all year round, starts at 31° latitude (She-hun City). Along the sea coast, a year round vegetational period exists only in the regions which lie 3° farther south, their northern borders are at 28° of latitude (Wen-chou City). The longer period of vegetation in Szechwan permits cultivation of many warmth-loving crops which cannot be grown at this latitude in other sections of China. For example, sugar cane, which is extensively grown in Szechwan, is not included in the technical crops of the provinces adjoining this province in the east and even in the south. Nevertheless, in Szechwan there are regions with a vegetational period lasting a total of 160 days, for example the Sung-p'an steppes in the north-west of the province. These differences in temperature make it possible to cultivate the most diversified agricultural plants in Szechwan; those which grow in the temperate, and in the sub-tropical and to some extent in the tropical belts of China. In the high-mountainous regions more cold-resistant crops are grown - including mountain barley, or ch'in-k'e and in the far south-west cacao, coffee and rubber trees. The Yangtze valley, within Szechwan, has a very hot summer and a very warm winter; it is also the most humid region of the province. Everywhere in this valley two, and on an experimental basis, even three harvests of rice are grown a year. In the

region around the city of Lu-hsi-an, where it is warmest and most humid, litchi, longana, olives and other fruit crops, which are very sensitive to low winter temperatures, are grown. There are many fruit-bearing banana trees and palms; along the banks of the Yangtze there are citrus orchards.

The rainfall in Szechwan is about the same as it is in the provinces of the basin of the central and lower reaches of the Yangtze. The main mass of rain falls here a little earlier than in the Yellow River basin and a little later than in the provinces along the central and lower Yangtze because of the presence of the south-eastern monsoon. In the northern part of the basin, the annual amount of rainfall is around 800 mm, in the south - in the Yangtze region - it averages more than 1000 mm; in the west the amount of rain is greater than in the east.

Precipitation during the winter half of the year in Szechwan is due to the north-western monsoon and falls, in most cases, in the form of fine freezing rain. While adding relatively little to the total precipitation, the winter rains saturate the air to the limit, leaving the soil unchanged moisture-wise which greatly benefits the growth of rape, beans and particularly winter wheat.

The greater part of the annual rainfall falls in the warmest months, as almost everywhere in China. The maximum heat corresponds to the maximum rainfall which is of course very beneficial to the growth and development of the plants. As a whole over a period of many years, the distribution of the rainfall over the annual seasons in Szechwan is about the same as in the southern regions of China; so that the highest degree of moisture occurs in the autumn and in the spring (Table 1).

TABLE 1

Distribution of rainfall over the seasons of the year (in %)

Station	Northern latitude	Eastern longitude	Annual amount of rainfall
Chungking *	29°33'	106°33'	1097.7
Ch'iung-shan **	19°58'	110°15'	1501.0

	spring	summer	autumn	winter
	25.7	40.9	28.0	5.4
	20.0	39.6	33.6	6.8

* Chang Pao-kun, 1954.

** Lu Ou, 1953.

This auspicious distribution of the rainfall over the seasons and its regularity over the years makes serious drought in Szechwan a rare occurrence. Irrigating by means of an accumulation of rain water is more reliable than in the other provinces. During the ten-year period since the liberation of China, Szechwan has not known a single serious drought and has been one of the few places where abundant and universally growing harvests have been gathered every year.

Within the Szechwan basin, the number of rainy days increases and the sunny days decrease from east to west; this explains the fact that on its western and south-western mountainous borderlands are concentrated the main tea plantations, which cannot withstand the direct rays of the sun.

The spring in Szechwan sets in earlier and is usually much warmer than on the central and lower reaches of the Yangtze. This contributes to earlier rice planting and cotton and fruit tree planting in this province. As early as May, in the suburbs of Chungking, apricots, oranges and papaya fruits are ripening. However the spring rains are frequently delayed which has led to the irrational practice of maintaining the water on the fields for the spring rice planting; this is the so-called system of winter water fallow (see below). After the second ten days of April, the air temperatures rise sharply and in May and June the amount of rainfall increases. In the eastern section of Szechwan, the period of downpours with thunder storms begins. In July and August, when drier weather sets in, in the western part of the basin (south-west of the Chia-ling Chiang) the rains reach a maximum here. Thunderstorms continue uninterruptedly in the west and, in two months, more than half the total annual precipitation has fallen. On an average the greatest amount of precipitation falls in the form of downpours in July and especially in August.

The summer downpours have a dual effect on the agriculture of this region. On the one hand, the abundant rain during these two months has a beneficial effect on the development of the rice, but on the other hand, it is harmful to the cotton crop. The high degree of humidity in the air causes the bolls to decay and the excess of water in the soil usually causes them to fall off. Towards autumn, the downpours are greatly reduced which is very beneficial to the harvest yield of the rice crop, which requires relatively dry weather when it is ripening.

The abundance of summer rains in Szechwan, the frequent thunder storms in the western section of the province, in the region of the upper reaches of the rivers, causes summer flooding which however pass over as quickly as they come on. The hilly territory of this province and the well worked deep river beds contribute to the waters' speedily subsiding. Therefore the floods which occur here are localized along the banks of the rivers.

In the autumn a large amount of rain falls in Szechwan. When the days are bright and sunny in the region along the lower reaches of the Yangtze, here there are freezing rains. The autumn is especially rainy in the region situated to the east of the Chia-ling Chiang. Because of this the cotton crops, which cannot withstand much moisture during the ripening period, are concentrated in the drier central and northern sections of the basin and are completely absent in the east. On the whole, cotton is not as important a crop here as it is in the basin of the central and lower reaches of the Yangtze and on the Great Chinese plain, because of the rainy autumn and the summer downpours in this province.

Szechwan has a more complex river system than many of the eastern plain provinces of China. Because of the bowl-shaped structure of its relief, almost all of its rivers run on a radius from the mountainous borderlands to the center of the basin. Since pre-historic times, the rivers, which penetrate into the most distant corners of the province, have played an important role in the agricultural life of Szechwan; they have been the principal transportation routes within and out of the province. It was their influence which historically formulated the distribution of the various branches of agriculture in Szechwan. The rivers were the main means of communication in the province and were a basic factor in determining the distribution of the most marketable crops like sugar cane. Sugar cane was first grown in Szechwan in Nei-chiang Hsien. From here this crop began to spread south and north along the T'o Chiang because of the advantages of transporting it by river to the Nei-chiang sugar refineries. As a result of this at the present time more than half of the area sown to this crop in Szechwan is concentrated in the regions along the banks of the T'o-chiang.

The importance of these rivers transportation-wise is further strengthened by the fact that the most navigable and the deepest sections of the rivers coincide with the most developed and thickly settled agricultural regions of the province - grain, tung oil, citrus fruits and other agricultural products are shipped from here down the rivers to the Yangtze and from there along the Yangtze to the other oblasts of the country.

As was mentioned above, the rivers of Szechwan are very seldom subject to flooding. This puts the agriculture of this province in a particularly advantageous position as compared with the eastern and northern regions of the country, which are periodically subjected to serious flooding and crop losses. The Chinese, who have established their country in a perpetual fight against the damaging floods of the Yellow River and the Yangtze, consider Szechwan the "promised land" in virtue of the almost complete absence of floods.

Nevertheless, the deeply cut beds with their fine, violet sands and the hilly fields above the water level, have always seriously complicated exploitation of these rivers for purposes of irrigation. In spite of this, in some places the rivers have acquired added significance for this very reason as sources of spontaneous irrigation

especially on the numerous wash-away cones. The Ch'eng-tu plain, for example, which is formed from an accumulation of these wash-away cones, has become the most intensive agricultural region in China thanks to spontaneous irrigation with the aid of the ancient "tu-chien-yen" irrigational system.

Almost all the soil types of China are represented in Szechwan, starting with the tundra soils down to the krasnozem (red soil). However most of them belong to the mountain type soils which has played an important role in the agriculture of this province. The most agronomically valuable soils are the so-called violet soils as well as the alluvial and brown forest soils.

The particular regional features of the process of soil-formation in Szechwan make for substantial differences in the soil cover of this province as compared with the other sub-tropical oblasts of China. This has an important practical effect on the agriculture of this province and brings to it a series of distinguishing features. The most sharply defined regional characteristics are noted in the varieties of violet soils. These soils are mainly to be found in China in the Szechwan basin where they occupy almost all of its territory up to 1000-1500 meters elevation. I. P. Gerasimov and Ma Yun-chzhi have related these soils to the genetic type of zheltozem (yellow soils). However they differ from the ordinary zheltozem which is to be found in most of the sub-tropical regions of China, in that they have developed on entirely different rock types - violet shale and sand deposits, which are to be found mainly in Szechwan. They give the soils their particular violet colour. The soils also have inherited a large content of mineral nutritive properties from them and the distribution of the soil profile is doubly diverse because of the physical attributes of its horizon.

The violet soils of Szechwan are formed under moist sub-tropical conditions - where all the biological and chemical processes are intensified - and there exists an abundance of warmth, light and moisture and an absence of periods of biological dormancy. The annual production of organic matter is increased and organic wastes are left in the soil on the fields which are under crops the year-round. The organic wastes decompose and mineralize speedily which does not contribute to an accumulation of large stores of humus in these violet soils but it does speed up the transferral of the nutritive elements of the plants from a non-assimiliative form to an assimiliative one which increases their actual fertility.

Despite the low humus content (1.5 - 2.5%) and the intensive year-round cultivation, the upper soil horizon of the violet soils has an agronomically valuable granular-crumbly porous structure. The lower soil horizon, on the contrary, consists of structureless, non-porous clay matter (SHUVALOV, 1957).

In the interests of agriculture, this clear-cut sub-division of the soil profile has both positive and negative sides to it. The low capacity of filtration of the low horizons helps to maintain the water

on the surface of the rice fields and in the reservoirs which permits complete utilization of the atmospheric rainfalls for irrigational purposes. The small losses and expenditures of water for irrigation of the rice fields has made Szechwan the region with the largest amount of irrigation by means of atmospheric water in the country; this water is gathered in small ponds or directly on the fields. When the land was divided up into small peasant holdings, this type of irrigation was the most acceptable because it did not require expenditures on complex irrigational installations but it is also uneconomical and unreliable.

The marl, porous structure of the upper horizon of the violet soils absorbs the water well and consequently has hydro-physical properties which are very beneficial to the plants, but its level of possible saturation is limited. This considerably lessens the penetration of atmospheric precipitation into the soil and heightens the loss from surface flow. Since the relief of Szechwan is very hilly, this process increases soil erosion. The region of violet soils in Szechwan is one of the areas of China with the largest degree of soil erosion and is only surpassed in this respect by the Lyossovvy plateau. Erosive processes are most highly developed in the elevated sections of the central part of the basin: in Sui-ming, Chiang-chin, Wem-chiang, Nan-ch'un, and Nei-chiang districts where the slopes of the hills are very ploughed up and the wood vegetation has been felled. Since the cooperization of the peasant holdings, the possibility of conducting an active and extensive fight against erosion has been made possible. This work has been particularly advantageous in the elevated sections of the central part of the basin.

The continual danger of the soils being washed off the steep slopes by the abundant summer rainfalls has been one of the main reasons for terracing the slopes of the hills in Szechwan. A large part of the arable land of this province is to be found on these artificial terraces; there is more terracing here than anywhere else in China with the exception of the Lyossovvy plateau. The importance of this terracing will grow rapidly in the future because as of 1958, all the fields on the slopes of the hills and mountains are supposed to be terraced over a period of from 2 to 5 years. ("Information Bulletin" 8 July 1958).

Besides Szechwan, Yunnan, Kiangsi and other provinces of central and southern China have small areas of violet soils, however Thorp (Thorp, 1938) says these soils are much less productive which has a lot to do with the climatic conditions of these provinces. In Yunnan, Kiangsi and other places, which are typified by clear sunny weather and a lot of evaporation in the late fall, winter and early spring, the winter crops on violet soils quickly lose their moisture and are continually suffering from drought; the harvests are consequently low or they are destroyed altogether if they are not irrigated. Even in summer, despite abundant rainfall, the crops on these soils can undergo considerable damage if the weather continues sunny for 7 to 10 days in

a row. The cloudy, foggy weather and slight evaporation in Szechwan, which prevails during the greater part of the year, protects the violet soils from drying out and despite their light mechanical composition and low capacity for water-retention in the upper horizon, they are usually sufficiently moist for agricultural crops even in winter when the rainfall is minimal.

The violet soils in Szechwan are planted to rice wherever there is enough water for irrigation. The non-irrigated sections of violet soils have been turned over to corn, wheat, sweet potatoes, beans, tobacco and other crops. In some places, particularly on the outskirts of the city of Nei-chiang, and along the banks of the Yangtze, between the cities of Wan-hsiang and Chungking, the main crop on violet soils is sugar cane. Citrus fruit is grown where climatic conditions are favorable. On the soil which has been very washed out and is not suitable for field crops, bamboo, pine, cypress and Nanma are grown. In some places the palm, which yields fiber and nuts, is economically important. In the south and south-west sections of the basin, tea leaves and walnuts are grown on violet soils.

The alluvial soils, which occupy the Ch'eng-tu plain and the narrow strips along the main tributaries of the Yangtze, play an important role in the agricultural activity of the population of Szechwan. These soils which have a high silt content are some of the most fertile soils in Szechwan. Thanks to their high humus content throughout the whole profile, they have a high degree of water-retention and a good structure. The highly fertile soils of the Ch'eng-tu plain and the possibility of spontaneous irrigation, as well as the favorable relief, have conditioned the exceptionally dense population of this plain. The fertility of the alluvial soils of this region is continuously subjected to extensive field fertilization, which is particularly intensive near the cities where the city wastes are used for this purpose.

Eighty per cent of the cultivated areas of the Ch'eng-tu plain are planted to rice. After the rice has been harvested, wheat, vegetables or green fertilizer is planted; in the north, in Kuan Hsien, after the rice harvest, medicinal grasses are sown. Besides the usual crops on the alluvial soils, along the Fou Chiang near the cities of Sui-ning and San-t'ai, cotton is grown and west of the T'o Chiang - sugar cane. In the valley of the upper Min Chiang, where the climate is drier, peaches and pomegranates are grown on alluvial soils.

In the mountains, which frame the Szechwan basin from the north, east, west and south-west and also in the Eastern Szechwan mountains, mountainous brown forest soils are developed which are adapted to the areas covered by broad-leaved and mixed forests of the temperate belt (Gerasimov and Ma Yun-chi, 1958). Within a few years after the forests have been Svedeniya, these soils become quite fertile and rich in humus, however when cultivated they are quickly exhausted, the top dark horizon which contains the humus disappears and erosion sets in very quickly. The old ploughed brown forest soils are usually poor in phosphate and unfertile.

The gradual slopes and floor of the narrow valleys, which are covered with soils of this type, are terraced rice fields but rice is not the most important crop here. The steeper slopes are planted to potatoes, corn, buckwheat and horse-beans. Along the borders of the fields and near the villages, tung and walnut are planted.

Based on data from 1958, the arable area of the Szechwan basin is around 21% of its total territory or 7.7 million hectares which is equal to 6.5% of the area of arable land in China. Considering the hilly, cut up relief, this amount of arable land, which exceeds one fifth of the territory, is quite high. The percentage of land being worked in the central and southern section of the basin is especially high. Here the arable area is 45-50%, and in the region around where the Chia-ling Chiang flows into the Fou Chiang and the Chiu Chiang in the T'o Chiang basin and in the hsien situated along the Yangtze from the city of I-p'in to the city of Wan-hsiang, the proportion of plough land is 70-80%; on the Ch'eng-tu plain - it is 90% and more. The mountainous borderland regions which surround the basin have the lowest percentage of arability. All of the 31 hsien located here contain only 16% of all the arable land of Szechwan. The western high mountainous section of the province is covered by large areas of pastureland and mountains overgrown with forests; cultivated fields are very seldom found here and the total area of them is very insignificant.

On an average there is 1.8 mu (around 1200 square meters) of arable land per person in the rural population of Szechwan (a little more than 3 mu is the average for the whole country). With such a low index, this province is characterized by the existence of large areas of land which still lie in waste but could be worked. The large virgin land masses, which could be worked with comparatively little difficulty, are located in the valleys in the south-west of Szechwan which have a sub-tropical climate. Formerly they were not exploited because of the sharp national antagonism between the Chinese and the local mountain tribes, which was kindled by the landowner-bureaucratic clique. At the present time with the introduction of democratic reforms in the Liang-shan autonomous district and neighboring regions inhabited by national minorities, these virgin lands have begun to be assimilated. In the valleys of the Chin-sha Chiang, Ya-lung chiang, and the An-ning Ho, plantations are being set up where crops heretofore unknown in this province are being grown such as - tree rubber, coffee, cacao, Kapokovoy palm and other tropical plants. Large masses of virgin land suitable for agriculture, amounting to 2-3 million hectares, are to be found on the high mountain plateau in the north-western section of Szechwan. However the sharp fluctuations in temperature over the day and the summer frosts call for the need of special supports and even new types of agricultural crops which could be cultivated under these climatic conditions. Soviet specialists consider it better to develop animal husbandry here for the time being and to exploit only small sections

for plough land. Under the more favorable climatic conditions of the Sung-p'an steppes, they are already organizing mechanized state farms to exploit the virgin land.

It must be mentioned that in order to assimilate new lands in the mountainous regions, where they are mainly located, large hydro-ameliorative operations are required which involve large capital investments. Therefore more attention is being paid at the present time to instituting a more intensive exploitation of already existing sown areas and particularly to the problem of improving the indices of recurrent sowing.

The recurrent sowing of rice and other crops requires a water supplement as well as additional fertilization. Therefore the main job of reorganizing and improving the agriculture lies in irrigational construction. Before the liberation of China, only around 20% of the total area of flooded lands in Szechwan had guaranteed spontaneous irrigation ("Jen-min Jih-pao" 23 July 1957); the remaining land was irrigated by means of accumulated rainfall. This "heavenly" irrigation depended on the abundancy of rain and the times at which it fell and could not always provide the rice fields with water in cases where the summer monsoon, which brings the moisture, was delayed. The most unprofitable type of "heavenly" irrigation was the so-called tung-shui-t'ien system - winter flooded fallow, which was used throughout China and mainly in Szechwan, particularly in the provinces of Kweichow and Hunan. The essence of this system is that many terraced fields during the autumn-winter season are used for accumulating rain water for use in spring rice planting. Only one rice harvest may be gathered from such fields and since rice grows from the middle of May to the end of August, the land lies fallow for the remainder of the year although the climate is suitable for growing agricultural crops the year round. If the spring were dry then most of the fields experience a lack of water for planting the rice and the sown area is reduced. Although this province has a fairly extensive area of water lands, the methods of irrigation are the most backward in China.

The main consideration in irrigational construction which has been unfolding since 1949, is being given to restoring the old system of irrigation, by improving its quality of displacing the "heavenly" irrigation with guaranteed spontaneous and mechanical irrigation.

TABLE 2

The change in the proportion of "heavenly" and guaranteed irrigation and growth of the area of watered lands. Szechwan (in million hectares)*

Year	Total area of watered lands	Lands with guaranteed irrigation	Lands with "heavenly" irrigation
1937	3.00	0.80	2.20
1953	3.45	0.95	2.50
1956	3.75	2.40	1.35

* Cheng Li-chan, 1947, "Jen-min Jih-pao," 23 July 1957; "Druzhba" 22 May 1957.

Seven years after the liberation, the total area of irrigated lands had been enlarged by 750 thousand hectares as compared with the highest indices before the liberation (1937) and the area of guaranteed irrigation, that is basically spontaneous irrigation, has tripled since 1949 and had reached 64% of the total water lands by 1957.

Most of the spontaneously irrigated lands used to be situated on the plain and in the sloping hilly regions. Spontaneous irrigation was used most extensively along the central and lower reaches of the Min Chiang and in the regions around the mouths of the T'o Chiang, the Fou Chiang and other rivers. The main feature of irrigation construction at the present time is that all of the new systems are being set up on hilly places. Whereas formerly only the most suitable places were spontaneously irrigated, this method is now being used all over the territory of the Szechwan basin.

The most important aspect of spontaneous irrigation construction has been the creation of a ramified system of canals. According to statistics formulated by the Irrigation Administration of Szechwan, from 1950-1955, more than 100 thousand canals were dug in the province, which increased the irrigated area by 450 thousand hectares. The development of irrigation by means of canals took a great step forward in 1956 when the area of spontaneous irrigation was enlarged by more than 500 thousand hectares in the course of one year. The well-known "tu-chien-yen" system of spontaneous irrigation which has existed for more than two thousand years on the Ch'eng-tu plain, has been restored and considerably extended in the last ten years. As a result the total area of irrigation, in this huge system, was increased from 220 thousand hectares in 1949 to 400 thousand hectares in 1958. The "tu-chien-yen" system has been extended beyond the limits of this plain into the surrounding hilly regions.

In the mountainous-hilly regions, work is being devoted to building shan-wan-t'an dams. These easily constructed dams can irrigate an average of 6-7 hectares of land, the larger reservoirs of this type - 100 hectares and more. By 1957, around 100 thousand large and small shan-wan-t'an had been built by the peoples' construction method which increased the area of spontaneous irrigation by more than 650 thousand hectares.

In spite of the large amount of work being done on spontaneous irrigation, there remain still very many rice fields which are situated at too high an elevation to employ this method. In cases like this, the use of mechanical water supply by means of pump stations is being employed more extensively; these stations are operated on power from small rural hydro-electric stations. Less than 330 hectares were irrigated by mechanical means before the liberation of Szechwan and only three pumping stations were in operation. ("Szechwan Jih-pao", 11 September 1954). In 1955, there were already 54 pumping stations in 26 uyezds which are capable of preventing drought and increasing the rice yield on an area of more than 4130 hectares. ("Jen-min Jih-pao" 5 June 1956). The total water area of Szechwan is still very small but in the future, mechanical irrigation will completely replace the extremely unprofitable method of winter water fallow in the higher sections.

A comparatively small area in Szechwan is watered by means of bamboo water wheels and water-raisers. The latter are used mainly for pumping the water from one terrace to another.

The use of new irrigational installations has made it possible to increase the stores of water and to provide guaranteed and regular irrigation over a longer period of time: the threat of drought has been reduced and in some places altogether eliminated. As a result of the fast development of irrigation construction in Szechwan, the areas sown to water rice, the main agricultural crop of this province, have grown larger. In seven years this area has increased by 500 thousand hectares which has yielded an additional 3 million tons of unrefined rice. At the same time, with the provision for more irrigation, the area of repeated rice sowing has begun to grow rapidly. Spontaneous and mechanized irrigation has added an area of 300 thousand hectares as well, because there no longer exists the need for collecting rain water on the former t'ung-shui-t'ien rice fields and has also made it possible to sow these fields again with wheat rape, vetch and other dry crops after the rice has been harvested.

1957 and 1958 were the years for reinforcing earlier achievements in the area of irrigational work in Szechwan. The growth of new irrigated areas was quite small for this period (110 thousand hectares), the total irrigated area, which made up a little more than half the arable land of the province, had reached 3860 thousand hectares in 1958. In order to fulfill the huge tasks which have been set for agriculture, it is planned to irrigate all the arable land in Szechwan in the near future.

In order to enlarge the sown area by means of improved exploitation of arable land, it is absolutely essential that the serious problem of supplemental fertilization be solved. The high intensity of agriculture in this province requires continual and abundant fertilization of the plough land. The most wide-spread type of fertilization is manure. Oil-cake from the Tungo nut rape and also from peanuts and cotton are used for fertilizing the olive crops. Agricultural wastes such as chaff which is ploughed into the ground are also universally used for fertilizer. In view of the need for organic fertilization, attention is being given to increasing the head of swine and to increasing the swine manure.

The method of sowing the crops on green fertilizer (sideration) has long been known in Szechwan but in the past it was employed on a very small scale. Since 1953, when the struggle to increase the sown area by means of using the large winter fallows was begun, green fertilizers began to be used all over Szechwan. Simultaneously chemical fertilizers are being used more and more; this type of fertilizer was almost never applied to the fields in the past. Phosphate fertilizers and bone flour, produced at the Szechwan plants, have increased considerably. Since 1955, they have begun to work with bacterial and granulated fertilizers in this province, which have had a very beneficial effect on agricultural production. New sources of local fertilizers have appeared. In 1956, a rich peat deposit was uncovered on the Ch'eng-tu plain, which has begun to be exploited and can already enrich with nitrogen up to 230 thousand hectares of rice fields ("Druzhba" 22 May 1957).

One of the most important results of irrigation construction and increased fertilization has been a considerable increase in the sown area of Szechwan by means of repeated sowing of agricultural crops, mainly rice. As early as 1957 the index of repeated sowing, which was established by the "Basic situation of the plan for developing the agriculture of the CPR from 1956-1967" had been surpassed. In 1967 - the sown area of the province exceeded the arable land by 69%, amounting to 13 million hectares (the arable land amounted to 7.7 million hectares.) It is planned for the near future to gather 2-3 harvests per year from 70% to the fields of the province (Wan Yung-tse, 1956).

In order to achieve the best economic exploitation of the sown area which has been enlarged by this method, maximum crop condensation by means of inter-row crop planting is being practiced. This system, which has been universally adopted all over China, is practiced most intensively in Szechwan. Inasmuch as crop condensation demands a reduction and alteration of the ripening periods of the crops so that they do not interfere with each other on the general field during the period of vegetation, preliminary sprout planting acquires an added importance in the practice of inter-row planting. In Szechwan at the present time sprouts are being set out in many regions, including rice, cotton, rape and in the north even corn and sometimes wheat sprouts.

The success of all of these methods of improving agricultural production will depend to a large degree on improving the crop assortment and using modern agro-technology. In this province a lot of work is being done on selection and standardization of different sorts of seeds; in 1956, a new high yielding type of wheat, with a short vegetational period, was introduced into Szechwan. Cold resistant types of sugar cane which are imported from India are being introduced extensively. From 1950 through 1958 the area sown to these types of sugar cane increased 100-fold and was over half of the total area sown to sugar cane. 80-90% of the cotton fields are being sown with improved seeds, and more than 60% of the wheat sowing, etc. By the end of the first five year plan, 23 improved types of various crops were in use. ("Jen-min Jih-apo" 25 September 1957 and 4 February 1958.)

The area of lands being ploughed to a greater depth with factory-produced ploughs and the area of thick (zagushchennyy) sowing have increased considerably. In 1954 thick rice planting was introduced on 70-80% of the crop area and in 1958 all the rice fields were planted by this method. Before the liberation there were almost no modern agricultural machines and equipment in the Szechwan countryside, whereas during the 1950-1959 period hundreds of thousands of modern ploughs, threshing machines, sprinklers and other inventory were introduced into the agricultural economy of this province; tractors also appeared. In order to improve agro-technology, an important role is played by the experimental stations and other state establishments. In the middle of 1954, 230 state farms and 511 agricultural, animal raising and forestration experimental-model points were established in Szechwan. ("Szechwan Jih-pao" 9 August 1954.") All of these organizations are called upon to instill progressive methods of agriculture into the peasantry, and distribute assorted seeds as well as introduce new equipment.

The fundamental reforms of the agricultural economy of Szechwan which is being carried out on the basis of cooperization, contributes to an immeasurable increase in the scales of agricultural production in the province and moreover to a greater specialization in various sections in the production of grain and olive crops, tea growing, citrus fruit growing and hog raising.

Szechwan is a large granary of China; more than 10% of all the grain harvested in China and 2/3 of the grain produced in South-western China is grown in Szechwan. This province is one of the few sections of the country with reliable harvests and has always provided grain for the regions of China suffering from flooding or from drought, mainly the provinces along the lower Yangtze. At the present time this province has become a food supplier to several northern and even north-western regions of the country.which are undergoing industrialization. Therefore the development of the grain economy of Szechwan is of great importance.

The problem of increasing the grain harvest can be solved by enlarging the areas sown to this crop and altering the structure of the sown area. The total sown area under grain crops had increased by 1957 by as much as 1500 thousand hectares as compared with 1952. A sharp increase in the area sown to more valuable and higher yielding grain crops such as rice, corn and to some extent wheat - is being accompanied by a reduction in the proportion of second rate crops such as barley, kaoliang, millet and others. The gross harvest of grain crops in Szechwan in 1953 had already surpassed the indices for the record year of 1938; in 1956 the province prematurely completed the first five-year plan, having harvested an average of 30.3 centners per hectare.

As the harvests increase, the marketability of the grain economy is growing. During the five years, beginning in 1953, when the system of state buying and selling of grain was introduced into China, more than 23 million tons of grain were bought in Szechwan, which is 27% of its production for that same period. In 1956 alone, 6 million tons of marketable grain were procured. A large part of the purchased grain is returned to the country, part of it remains for the economic needs of the province and part of it is exported to other sections of the country.

TABLE 3

Dynamics of production and export of grain from Szechwan*

Year	Grain production thous. tons	Szechwan share of the grain production of China, %	Growth of harvests China	Growth of harvests Szechwan
1938	17,975	-	-	-
1949	10,930	9.74	100.0	100.0
1952	16,850	10.81	142.8	154.0
1954	18,750	11.70	148.4	171.5
1956	22,250	12.20	168.8	203.6
1957	23,816	12.87	171.1	218.0

	Export thous. tons	% of harvest
1938	--	--
1949	--	--
1952	469 **	2.6
1954	840	4.5
1956	1812	8.1
1957	2800	11.8

* "Jen-min Jih-pao," 31 August and 14 June 1957; "Druzhba" 16 Jan, 1957; "Narodnyy Kitay" 1957, No. 4; "Shan-yu, 1958, No. 6

** Data based on 1953.

The grain economy of Szechwan, as was mentioned above, is primarily rice-growing. Almost all of the rice fields are concentrated in the Szechwan basin, where it is cultivated wherever irrigation is possible. The largest producer of rice is the Ch'eng-tu plain, where this crop occupies more than 80% of the arable land, in several uyezds of this plain - Wan-chiang P'i-hsien and others - 98% of the arable land is planted to rice. Ch'eng-tu plain is the model region of irrigated crop cultivation in China; 10% of the rice harvest of this province is taken from this plain which is little more than 1% of the territory of Szechwan. The rice is exported from here to the coal-mining region of Le-shan, Ch'ien-wei, Chi-kun, Chungking and beyond the borders of the province.

Other surplus rice growing centers are the south-western region along the Yangtze between the cities of I-pin and Chiang-chin and the region of the central and lower course of the Fou Chiang.

Szechwan produces twice as much rice as corn, wheat, kaoliang, barley and other grain crops taken together. The proportion of rice in the gross harvest of food crops of the province was more than 60% during the first five-year plan and was only around 35% of the area sown to them. Therefore the development of the rice growing economy is the most profitable direction the grain economy of the province can take.

According to statistics from Shen's report (Shen, 1951), the area sown to rice from 1931-1937 - which was the most auspicious period in the agriculture of Szechwan before the liberation - averaged 2700 thousand hectares. After 1949 the area sown to rice increased more rapidly than the area sown to any other crops. According to statistics of the Ministry of Agriculture, it increased from 2666 thousand hectares in 1950 to 2806 thousand hectares in 1952. In 1957 rice occupied around 4150 thousand hectares.

Not only has Szechwan surpassed the old indices for the area sown to rice but also the indices for the rice harvest yield: the yield was 28.7 centners per hectare during the pre-war period, the average for the province was already 32 centners of rice in 1952. The total harvest of this crop grew from 7.5 million tons a year on an average for the period from 1931-1937 to 9 million tons in 1952. In recent years it has increased to 14 million tons which is around 17% of the gross rice harvest of the country.

The increased production of rice has a lot to do with the growth of the area of repeated sowings. Cultivating of two rice harvests a year began on the experimental level in the southern section of Szechwan from 1937 to 1943 when the province became the main granary of the regions not occupied by the Japanese; the area of repeated rice sowing reached 6 thousand hectares at that time. However after 1944, this land began to be gradually cut back and by 1949 dual-harvests of rice were cultivated in only a small amount and only in Lu Hsien. The comparatively complicated techniques of working the fields, the absence of fertilization and backward methods of irrigation all represented

serious obstacles under the small peasant holding economy and doomed the efforts to introduce repeated rice sowing to its unavoidable downfall.

In 1951 the people's government began to take measures to reinstate the previous areas of repeated rice sowing and introduce this system of rice sowing in all of the climatically suitable regions of Szechwan. Since the introduction of socialist reforms in the agricultural economy and the considerably greater effectiveness of peasant labor, the areas sown to repeated rice sowings were rapidly increased and in 1958 two rice harvests a year were being gathered over an area of around 1.3 million hectares or from one third of all the rice fields of Szechwan. ("Druzhba", 1958, No. 39).

The main areas where repeated rice sowing is practiced is in the south of the province in the region of the Yangtze River (around I-pin, Lu-chou, Chiang-chin,) and on the Ch'eng-tu plain, in some places as far as 31° latitude. At the present time in Szechwan there are estimated to be 3 million hectares of irrigated land suitable for this system of rice planting, thus with time around 85% of all the rice fields in this province may be growing two harvest of rice a year.

Besides the water rice, dry rice is also cultivated in Szechwan but it only occupies around 10% of the area of the rice fields. The proportion of rice grown on dry fields makes up even less of the gross rice harvests because it seldom gives a harvest of more than 50-60% of the water rice harvest. The advantage of the dry growing rice is that it is impervious to conditions; it is grown on the mountain slopes in small scattered patches and mostly in the west and east of the basin and in the Eastern Szechwan mountains where conditions do not permit irrigation but there is sufficient rainfall for this crop.

Corn is in second place in Szechwan according to the size of its sown area and harvest. During the period from 1931-1937, the area sown to corn was equal to 681 thousand hectares, the harvest was 1381 thousand tons or 20% of its production in China. In 1952 the area sown to corn was already 1077 thousand hectares (the harvest - 1477 thousand tons) and in 1956 - 1600 thousand hectares. ("Hsinhua Agency news release" 11 September 1956. The corn fields are usually planted above the rice fields on the steep slopes.

In the hilly and drier regions of the northern half of the Szechwan valley, corn is the main summer crop. In dry years, there is more conformity in the extension of the area sown to corn at the expense of the area sown to rice here. In these years corn is grown on lower fields after which it again makes room for the rice. This crop plays an important role in the east and in the south of the province as well - along the banks of the Yangtze and west of the Min Chiang.

The basic method of cultivating corn in Szechwan is to plant it thickly along with other crops. In the mountains up to an elevation of 1000 meters above sea level, the most common crops planted between the rows of corn, are beans and sweet potatoes. In the regions where

technical crops are sown including cotton, peanuts and others - the corn is planted between the rows.

According to ancient Chinese literature, kaoliang, which used to be known as "shu" or "sorghum from the Shu principality" spread over China from Szechwan in the IV century A.D. At the present time Szechwan is surpassed only by North-eastern China and the region along the lower reaches of the Yellow River in its kaoliang production. It is cultivated in the regions where corn is wide-spread. It is extremely impervious to outside conditions and gives comparatively high harvests even in unfertile ground because it has an extremely ramified root system which is very capable of assimilating nutritive substances. Thanks to this characteristic, kaoliang is also more drought-resistant than corn. In virtue of these properties it has not been replaced by corn but it has lost its role as an important food crop and is now used in Szechwan mainly as raw material for producing wine and cattle feed.

The most important grain crop during the winter period is wheat.

According to the quality of the wheat and the season in which it is cultivated, China may be divided into three regions, on the butt of which lies Szechwan. The high mountainous west of the province belongs to the region of hardy spring wheat which is the best quality wheat. But in this sparsely populated section of Szechwan, there is only a small proportion of the total area sown to this crop and it does not have much economic significance. Here, at an elevation of from 2500-3100 meters above sea level, runs the upper limit of wheat cultivation in China.

The mountainous-hilly northern section of the Szechwan basin belongs to the region of semi-hardy winter wheat which ripens early, which allows this crop to be cultivated in rotation with beans, sweet potatoes and other summer crops. The harvest yield of local grain types is higher here than anywhere else in China. The whole central and southern sections of Szechwan belongs to the southern-Chinese region of soft winter wheat which yields a lower quality of flour.

Thus, the wheat is almost universally cultivated as a winter crop. The main wheat areas are concentrated in the northern part of the basin, in the region of the central section of the Chiai-ling Chiang and the upper reaches of the Fou Chiang and the Chiu Chiang. Next in importance are the Ch'eng-tu plain and the region around the cities of Ya-an and Hsi-ch'ang.

The wheat harvests were always second only to rice but, during the agricultural decline in the 1940s, the harvest yield of wheat diminished and at present, its share in the grain balance of the province is lower than that of corn.

TABLE 4

Dynamics of the sown area and wheat harvests *

Years	Sown area, thous. hectares	Yield square hectares	Harvest, thous. ton
1931-1937	1036	1750	1813
1950	1269	803	1054
1956			
1956	1260	1240	1570
1957	1360	1205	1640

* Shen, 1951; "Druzhba" 8 June 1956 and others.

At present the wheat production of the province is already approaching the highest average level achieved during the period from 1931-1937. In 1956 the index for gross wheat harvest, which was proposed for the end of the first five-year plan (1957) was surpassed by 22.7%.

The second most important winter grain crop after wheat is barley. Szechwan holds first place in the country for its barley production. Due to the fact that the vegetational period of barley is shorter than that of wheat by 2-3 weeks, it serves as the best component in annual crop rotation with other crops. This feature makes it also the most suitable crop for the mountainous regions where the climate is dry; it is grown here at a very high altitude. In the mountainous north-west and west of Szechwan, it is planted on the southern sunny slopes up to 4000 meters above sea level.

Barley is mainly grown in the north of Szechwan but it is also quite widespread in the central regions of the basin because it does better under moist climatic conditions and poor drainage than the other winter crops. Barley is grown here in crop rotation with crops having a longer vegetational period. At the present time with the development of the selective factor, this crop is beginning to be replaced in the central regions by more valuable cereal grains. In the basin of the Fou Chiang, where barley used to be the main component in crop rotation with cotton and in the basin of the T'o Chiang where it was sown after sugar cane, it is now being replaced by early-ripening types of wheat adapted to the local climatic conditions and soils. As a result of this substitution, the sown area and production of barley in Szechwan is being reduced and whereas in 1931-1937 it was only a little behind wheat in its sown area; in 1952 it fell behind by more than two times (537 thousand hectares.)

The most important source of food oil in Szechwan is rape. Since rape is harvested in the early spring and yields a lot of green mass which is frequently ploughed into the ground as a fertilizer, it serves as a good forerunner for the rice crop which is very important to rice-producing Szechwan.

Rape is also a good vegetable crop. In the winter and spring, its young sprouts are the main green table seasoning in Szechwan. The oil-cakes of the rape plant are an excellent concentrated fodder for the cattle; it is particularly valuable for the swine of which there are more in Szechwan than anywhere else in China. Rape oil is the most effective and principal fertilizer used on the huge sugar cane fields of the province. The favorable climatic conditions, and the variety of ways in which this crop can be put to use in the complicated system of agricultural specialization existing in Szechwan, have made rape next to wheat the main winter crop of the province.

Szechwan province, like Kweichow and Yunnan provinces, is the most important producer of rape in China. In the period from 1931-1937, the area sown to this crop in Szechwan was 734 thousand hectares or a little more than one sixth of all the area sown to this crop in China and the seed harvest had reached 624 thousand tons or one fourth of the gross harvest of the country (Shen, 1951). During the war with Japan and during subsequent years of collapse, the rape harvests in Szechwan have fallen off sharply. At the present time, this branch of the agricultural economy is being restored; in 1956 the area under rape had increased to 380 thousand hectares. ("Hsinhua agency news release" 10 May, 1956"). In 1957 the seed production of rape had reached around 275 thousand tons or more than 30% of the gross harvest of the country.

The general reorganization of the system of cultivation and its increased intensification after 1949 were reflected in the methods of cultivating rape. Since the introduction of repeated rice sowing, rape has begun to be planted in seedlings especially in the most northern region of the dual rice harvests - Ch'eng-tu plain - because otherwise it does not have time to ripen before the second rice planting in April. The largest areas of rape sowing are concentrated on the Ch'eng-tu plain. It is also extensively cultivated in the basins of the T'o Chiang (Lu-chou and Nei-chiang districts), the fou chiang (Mien-yang and Sui-ning districts) and along the banks of the Yangtze. Rape is mostly sown around the cities and villages which can provide surplus wastes for fertilization. The supply of chemical fertilizers and oil-cakes to the peasants, who are cultivating rape, is now being stepped up. This is making it possible to enlarge the sown area in the regions situated at some distance from populated points.

Among the other oil crops, soy, peanuts and sesame also occupy a large area. The first two are grown mainly in the basins of the Chia-ling Chiang and the T'o Chiang; sesame is mainly grown on the Ch'eng-tu plain. In the past peanuts were not essentially an oil crop because it

was almost totally used for food. Since the fall of 1954, the situation has changed drastically. Peanuts under the centralized system began to be bought as fat for the oil-making industry.

The production of oil crops is really the weakest link in all the fast-developing branches of agriculture in which Szechwan specializes. It is growing at a rate far behind the economic requirements of the country. At the present time the harvests of oil crops is being increased mainly by improving the harvest yield: improving the agrotechniques of cultivation, introducing more productive types of rape, in particular the "shenli" variety. Other effective measures which are being taken to increase the production of oil crops, is sowing soy, peanuts and sesame on the corn and kaoliang fields which considerably increases the harvest of these crops in regions where corn is cultivated.

Tung occupies a special position among the oil crops cultivated in Szechwan. Tung at the present time plays an important role in the economy not only of this province but of the whole country, despite the fact that in the not too far distant past this wood which is endemic for China and yields the most valuable industrial oil, existed in Szechwan only in a wild state and the oil was used on a very limited local basis mainly for lighting.

Tung wood was first introduced into the economy of Szechwan as an industrial crop in the beginning of the XX century, much later than in the provinces of Chekiang and even Hunan which borders on Szechwan which was due to the difficulties of exporting the oil. With the development of steamshipping on the upper reaches of the Yangtze in the beginning of this century, the ground was laid for turning the Tung industry into a very important branch of the agricultural economy of Szechwan. Over the twenty year period from 1912 through 1933, the export volume of tung oil had grown 100 times and this province had become the most important tung supplier in China. Beginning in 1922 up to the present time, Szechwan yields an average of 40% of all the tung oil exported out of China, which supplies on the world market 85% of this product.

The best places for establishing tung plantations are the territories protected from the winds because the tung tree cannot withstand them. The relative lack of wind in Szechwan provides excellent conditions for this crop as compared with other provinces of China. For this heat-loving crop, the climate of Szechwan is particularly well-suited with its mild, almost frostless winter, temperate amount of precipitation, its very high relative humidity and cloudiness and high summer temperatures. Therefore almost every uyezd in this province produces tung oil.

Since the tung tree demands very little of the soil, it is not cultivated on land which is suitable for other crops and it is planted almost exclusively in the mountains, on the tops of hills and on rocky wastes. As a rule, it is grown along the rivers where it can be transported by water. The main tung centers are situated in the Eastern-

Szechwan mountains - in Lin-shui, Chung-hsien and Yun-yen hsien, where 55% of the tung oil of Szechwan is produced. This region, taken as a whole, supplies around 80% of the oil in the province. The next in importance is the south-eastern region or the basin of the Wu Chiang which has almost exactly the same natural conditions as the preceding region. The production of both these regions supplies around 90% of the total oil output. The third most important region for growing tung tree is in the basin of the Chia-ling Chiang. The tung tree is found everywhere here but it is only grown as a subsidiary crop.

In 1956, 210 thousand tons of tung nut were gathered in the province which surpassed the high harvest level reached before the liberation. ("Hsinhua Agency news release" 9 September 1956). Because of the increasing demand for tung oil in China and the increasing demand for this product in the socialist countries, the tung economy of Szechwan is being reorganized. From having been a side occupation of the peasantry, it is gradually becoming an independent branch of the agricultural economy. Many specialized tung plantations have come into being: the largest of these, which account for 300 thousand trees, are located in Wan-hsien and P'i-shan Hsien along the Yangtze in the Eastern Szechwan mountains.

The tea shrub, which is an important industrial crop in Szechwan, grows best here on light soils at an altitude of up to 900 meters above sea level. It is grown only along the mountain periphery of the Szechwan basin. It is not cultivated at all in the central part of the basin.

An excess of sun light and an excess of moisture in the ground reflect unfavorably on the quality of the tea leaf. Therefore the high temperature, the relatively high humidity of the air and the especially frequent fogs, which are typical of Szechwan, protect the plant from the direct rays of the sun and have a very beneficial effect on the quality of Szechwan tea. The leaves remain tender and the shrub actively "drives off" the young shoots. In the parts of the province where there is not so much fog, the tea shrubs are shaded by Ch'in-ou-k'a-mi placed on bamboo poles a little before the tea harvest.

In Szechwan, probably more than anywhere else in China, a huge assortment and variety of tea is grown - from very thin aromatic green tea to coarse brick-tea. The reason for this variety is the geographical position of Szechwan: not only must it supply the demands of the nomadic cattle-breeders in the Tibetan highlands and the demands of its own population, but it must also provide for the diverse tastes of the national minorities of the Kweichow plateau and inhabitants of the neighboring northern provinces.

The main tea-growing regions are the mountainous western, northwestern and south-western borderlands of the Szechwan basin. The western region, which lies along the Min Chiang - from the city of Wen-ch'uan in the north to the city of I-Pin in the south - produces half of all the tea produced in Szechwan. Along the central part of the Min Chiang, the tea is planted in high steep places. The strong-scented

tea of this especially foggy region is considered the best tea in Szechwan. On the lower course of the river and further south, where the mountains are not so high and steep and where there is less rainfall and fog, the tea is of much lower quality. In the north-western region (An-hsin, P'in-wu, Pei-ch'uan and other hsien) not much tea is produced. The eastern section of Szechwan also produces comparatively little tea with the exception of the north-eastern hsien of Ch'en-k'ou, Wan-yuan-i and a few others.

The tea production of the province fell off a great deal before the liberation of China, which was partly due to the diminished export of tea to Tibet and Sinkiang; which began to use ever-increasing amounts of India tea instead of Szechwan tea. After 1949, the tea economy of the province began to be reorganized. Since 1952 cooperization of the tea growers has spread and the scattered tea areas have been united into unified large groups. State aid to the tea growing cooperatives, in the form of credits, mineral fertilizers, sets and agricultural equipment has played an important role in raising the tea industry. A beneficial policy of prices has also been introduced and scientific-research operations on selection and agro-techniques conducted the experimental tea-growing station in the city of Kuan-hsi-an and have also contributed to this branch of agriculture.

The large market for Szechwan teas in the countries of the socialist camp has also had a beneficial effect on the development of tea-growing in this province. In order to satisfy the demands of the outside market, specialization in various kinds of tea is being revised and intensified in the different regions. Thus the southern region on the right bank of the Yangtze between the cities of Sui-fu and Ho-chiang is now producing a kind of black tea for export to the USSR and the peoples' democratic countries of Eastern Europe instead of various kinds of green tea for the domestic marker. Black tea has begun to be produced in eastern Szechwan for this purpose. Szechwan has also begun to supply more tea to the western provinces of China. Therefore the western and north-western regions are specializing more in the kinds of tea in demand in the Tibetan highlands.

All of these measures have brought about a growth in tea production. Whereas in 1949, the total tea harvest of Szechwan was 5 thousand tons, in 1952 it was 7.5 thousand tons and in 1956 it had already reached 16 thousand tons. ("Druzhba" 27 March 1957.) This last figure is more than three times the 1949 harvest. At the present time this province holds third place in China for the area planted to tea. In 1955, this area amounted to 19.2 thousand hectares or around 7% of all the land in the country planted to tea but because the average tea yield in Szechwan (33 centners per hectare) is more than twice as high as the average yield in the country as a whole, the gross harvest is second only to the province of Hunan and produces around 15% of the tea in China. In China as a whole the tea production has not yet reached the pre-war level but in Szechwan in 1952 it had already surpassed it and it is now approaching the indices for the period when tea-growing

was at its height at the beginning of the XVIII century. Since 1957 many new tea plantations have been established in the province; in that year according to the plan, tea plantations were supposed to be laid out over an area of 6.7 thousand hectares which is almost equal to one third of the whole area of tea planting in Szechwan. The new plantations are being set up mainly in the Western part of the province.

Szechwan is very rich in orchards. The most important of its fruit plants are the citrus fruits. The warmer climate of the basin has permitted citrus fruit to be grown here on a much wider basis than in the eastern part of the country. A full accounting of the number of citrus trees has not yet been made; therefore the figures on the area planted to citrus trees has been determined by means of cross-calculations using the number of trees as the initial figure. The actual situation is only vaguely reflected by these figures and they represent more likely an under-estimate than an exaggeration. The agricultural agencies have only begun working on information of a statistical nature in the field of citrus growing since 1953.

In 1936, the area under citrus crops in Szechwan was 4.7 thousand hectares with 1.6 million trees, the harvest was 200 million fruits or around 35-40 tons (Chen Li-chiang, 1947). These were the high pre-war indices. Further development of the citrus growing in Szechwan was impeded by the limited market sales owing to the high cost of transporting the fruit. The citrus economy of Szechwan was severely damaged by US competition, because the inexpensive California oranges which were tax-free and could be shipped conveniently by sea over-ran all the cities in the east of China all the way to Han-k'ou and even to the borders of Szechwan.

After the liberation of China, a good deal of attention was devoted to restoring the citrus production of Szechwan. The areas planted to citrus trees were extended in the mountain regions. An important factor in increasing the harvest yield and production of citrus fruits in the regions of industrial citrus growing in Szechwan were the broad measures which have been taken by the peoples' government to increase the export and procural of fruit for the domestic market, to give the peasants credits and improve the supply of chemicals for fighting disease and such devastating pests as the citrus fly which destroyed around 40% of the orange harvest in Szechwan in 1951.

In 1952, 7.5 thousand hectares were planted to citrus crops in Szechwan or 27-30% of the total citrus orchards of China; the marketable fruit harvest, characterizing only the size of the harvest realized on the domestic and non-domestic markets, was 54 thousand tons. In 1954 the area planted to citrus fruits grew to 8 thousand hectares and the gross harvest to 61 thousand tons. In 1955 the area under citrus crops in Szechwan (together with Kwang-tung province) increased by 4 thousand hectares. ("Szechwan'zhibao" 14 Sept. 1954). While there was an absolute growth in area and harvest in the last few years, Szechwan's share

in the citrus economy of China was somewhat less because of the even faster restoration and development of citrus growing in Kwang-tung and Hunan provinces. Nevertheless Szechwan continues to maintain its primacy in this field.

The most northern points in China where citrus fruits are grown out in the open are in the northern section of Szechwan where sheddoki and mandarines are grown on the southern slopes of the mountains which are protected from cold winds. The most northern point of industrial citrus cultivation in China is also located in Szechwan, northwest of Ch'eng-tu city in Chin-t'an Hsien. Farther south, citrus fruit is grown universally but in scattered patches, mainly in the river valleys in places where the soils are suitable for the cultivation of this fruit. The centers of industrial citrus growing are located along the rivers primarily because of the convenience of shipping the fruit for sale on the domestic and foreign markets. The citrus orchards of an industrial nature are concentrated on the territory stretching from the 31° parallel of latitude south on the right bank of the Yangtze. The citrus orchards are especially numerous near the large cities and the coal and salt industrial regions. Here they form huge orchards - plantations. Ho-ch'uan, Chiang-ching, Pa, and Ch'an-shou hsien, which border on Chungking and the regions of the coal industry, produce almost 60% of the citrus harvests.

The orchards are located mainly on the terraced slopes of the hills. On the steep mountain slopes, the citrus trees grow in disorderly groups or in isolation on the edges of the terraces of the rice fields. Unlike the other regions of China, where the citrus trees are planted very close together and the citrus orchards are not sown to agricultural crops, in Szechwan the trees are planted far apart so that food crops can be grown between them. The density of citrus plantings here is more than twice as low than in the orchards of other oblasts of the country. The Szechwan peasants consider the dense orchards uneconomical because when the trees are planted more sparsely and cared for properly, the fruit harvests are higher, besides which rice, rape and other crops can be grown in the orchards as well.

Citrus growing in Szechwan has one other distinction. In China, as a whole, mandarines are the main citrus fruit and oranges are in second place, in Szechwan oranges are the most prevalent citrus fruit; Chiang-chin and Chin-t'an hsien are especially famous for this fruit. Mandarines are cultivated here in smaller quantities, the main regions for the production of mandarines are Nan-ch'un and Pa hsien. Sheddoki are grown in third place, like in all of China. This fruit is mainly grown in Wan Hsien in many different varieties. Lemons are grown in very small quantity, (in the foothills of Ch'ung-chin and Chin-t'an hsien). For medicinal purposes, a small quantity of citrons and bigaradii are grown. Szechwan is known all over China of its oranges and mandarines. Szechwan oranges have a high sugar content and are very small and juicy and in most cases have a very low acid content.

Szechwan has unlimited possibilities in the production of all citrus fruits for export and the domestic market. The poor development of transportation and the great distance of this province from the sea has limited the production and shipping of this fruit in the past. However the variety of citrus fruits, especially the sheddoki, grown in Szechwan, can be kept for a long time and therefore are highly transportable. In order to completely exploit the citrus growing possibilities, these qualities must be further developed in the scientific work which is being done on new kinds of citrus fruits. New effective ways of preserving the fruits while they are being stored are also being worked on. All of this, combined with the booming growth of the industrial cities of Szechwan, the establishment of the Chungking to Ch'eng-tu to Pao-chi railroad which connects this province with the northern sections of the country and the improvement of shipping on the Yangtze, are setting up the prerequisites for Szechwan's future specialization as a producer of citrus crops.

Besides the afore-mentioned food and technical crops, Szechwan occupies a very important position in China in the production of sugar cane (the province produces 25% of the gross harvest of the country), peas (20%), horse beans (20%), rami (20-25%), medicinal herbs and several other crops.

The province plays an important role not only in crop cultivation but also in the animal raising branch of agriculture. In Szechwan, which lies between the crop cultivating east and the animal raising west of the country, the type of animal raising which goes on in China as a whole is fairly accurately reflected. As far as its importance, the way in which it is carried on and the stock makeup are concerned, Szechwan, like the whole of China, is sub-divided into a large cattle raising region in the western high mountains, a crop cultivating basin and intermediate crop cultivating-cattle raising zone which lies between the two and which includes the western and the north-western mountain borderlands of the basin. The most representative animals for these regions are respectively yaks and sheep, buffalo and pigs, sarlyki and goats.

Unlike the semi-desertous steppes of the northern cattle raising regions of China, the pastureland in the western part of the province is very grassy and does not lack for water. However, due to the absence of convenient types of transportation, the marketability of the rich livestock raising regions of western Szechwan is still fairly low although it is continually increasing with the development of the road system.

In the crop cultivating basin, livestock raising is subordinate to field cultivation and departs from it. The main branches of animal raising here are the breeding of work animals and hog raising. As in the whole southern section of China where the climate is sub-tropical and tropical, buffalo are bred for both work and meat animals because

they are well adapted for the heavy labour on the marshy rice fields. Being the largest region of water rice growing, Szechwan takes first place in the country for head of buffalo; 18-20% of all the buffalo in the country are concentrated in this province. Most of the buffalo are found in the central and southern sections of the basin, in the main rice-producing regions.

The lack of pastureland and the poor development of grass sowing have led to hog raising's becoming the main branch of productive livestock breeding in the basin. The problem of increasing the number of hogs and the production of grain and oil crops is the most important joint task before the agricultural economy of the province which occupies a position of importance in the country in these three branches of agriculture. Without increasing the production of grain and oil crops, which provides most of the hog fodder, it will be impossible to develop hog raising in the province. At the same time, inasmuch as Szechwan produces very little chemical fertilizer, the growing accumulation of hog manure is an important measure and a necessary prerequisite to insure reliable highly productive field husbandry. The importance of hog raising is also determined by the fact that its production serves as an important article of export. One fourth of the export of bristle from China comes from Szechwan; this province yields one half of the white bristle exported out of the country which is considered the highest quality bristle on the world market.

The solution of the feed problem is the most important problem in present-day hog raising because there is not enough grain for the fast growing hog stock. Among the measures contributing to the development of hog raising, the agricultural agencies recommend the use of economy rations with a very small expenditure of concentrated fodder and the use of food wastes (garbage), coarse and rich fodder and also wild plants. Unified planning of the area sown to fodder crops is being carried on. The free land - winter fallow and scattered land resources - are being exploited for growing food and sidereal crops so that part of the latter can be used for feeding the hogs.

All of these measures have made it possible to increase the rate of development of hog raising in Szechwan faster than in China as a whole. Whereas in 1936 the head of hogs in Szechwan was around 13%, in 1954-1956 its share had grown to 20% of all the head of hogs in China and around 7% of the world hog stock. Both in total head of hogs, as well as in the number of pigs, according to the unit of arable land and per population, Szechwan holds first place in China.

At the present time, there are twice as many hogs per 100 persons in this province, than in the whole country on an average. The dynamics of hog raising in the province reflect the following data: (Chien Chiung-chan, 1945; "Narodnyy Kitay", 1957, No. 4; "Szechwan Jih-pao" 24 September 1954. "Jen-min Jih-pao" 14 July 1957. "Dagunbao" 8 January 1959.)

Year	Head of hogs
1936	8,200
1952	12,000
1956	20,000
1957	24,000
1958	37,600

During the first five-year plan the head of hogs in the province almost doubled. Besides the growth in the head of livestock, the export of hog raising production to other regions of China and abroad also increased.

The agriculture of Szechwan like all over China, is in a stage of crucial revolutionary reform. The restoration of its gross pre-war level of production was already reached in 1952. During the period from 1952-1955, when new agro-technical methods and progressive measures of irrigation had just begun to be introduced and were being carried out on the basis of still undeveloped types of cooperatives, the value of gross agricultural production in the province increased by 19%. ("Jen-min Jih-pao" 19 September 1956). Since 1956 the rate of growth has continued to increase.

At the present time big advances are being made in the qualitative composition of agricultural production as well as in crop distribution. The crucial moment, after which agriculture in Szechwan began to change particularly rapidly, was in the second half of 1955 when cooperation had assumed large proportions and especially active irrigational and land-regulating operations were started. For the first time in its history, winter became a period of intensive labor whereas it had always been a traditional period of rest. The tenacious collective labor of the peasants is transforming the agricultural landscape of the province. In the hilly regions, new terraces and numerous reservoirs are coming into being. Particular attention is being given to land-regulating operations in forestry. It is planned to plant the whole of Szechwan with trees over a period of 10 years beginning in 1956. The area of forest which will have been restored during this period will be 30% of the territory of the province (Wang Yung-tse, 1956). This will prevent soil wash-away on the naked slopes of the mountains and will play an important role in increasing fertility and preventing local flooding and drought.

The transformation of Szechwan into a region of two annual rice harvests, the appearance of new crops in the sub-tropical south-west, the extension of the sown area in the north-west, new ways of organizing labour, the use of new techniques - thanks to all of these elements of general reform, this province will become one of the richest agricultural areas of the country.

BIBLIOGRAPHY

Wang Yung-tse, Szechwan Province. Shanghai, 1956 (in Chinese).

Gerasimov, I. P., and Ma Yung-chih. Genetic types of soils on the territory of the Chinese People's Republic and their geographical distribution, Moscow, 1958.

Lu Ou. The Climate of China. Peking, 1953 (in Chinese).

Liu Shih-ch'i. Geography of Agriculture of China. Second edition. Shanghai, 1956 (in Chinese).

Basic situation of the plan for the development of agriculture in the CPR from 1956-1967 (Revised plan) Supplement to the magazine "Druzhba", 1957, No. 7.

Chiang Chun-chang. Economic geography of the South-west (Hsi-nan Ching-chi) Ti-li, Chungking, 1945 (in Chinese).

Chen Li-chien (editor) New geography of Szechwan (Szechwan Hsin) Ii-chih) 1947 (in Chinese).

Shuvalov, S. A. On several general characteristics of soil formation in the humid sub-tropical zone of China. "Soil Science" 1957, No. 4.

Ch'ang P'ao-k'ung. On the duration of the four seasons in China; in the collection "Collected Scientific Papers". Meteorology (1919-1949) Peking, 1954. (in English)

Shen, T. H. Agricultural Resources of China, Ithaca-New York, 1951 (in English)

Soils of Szechwan Province "Soil Bulletin" No. 24, Chungking, 1944.

Thorp J. Geography of the Soils of China. London, 1938.

IV. Problems of Agricultural Production and Assimilation of Tropical Resources in the Southern Coastal Region

by K. N. Chernozhukov

At the present time an important task has been set before the people's economy of China - the extension of agricultural production and assimilation of tropical resources in the Southern Coastal Region. The Southern Coastal region is one of the agrarian regions of China where, because of the underdevelopment of industry, its great distance from the old industrial centers, inadequate prospecting of resources and a series of other factors, socialist industrialization did not take place during the first five-year plan (1953-1957) and will only gradually be realized in the course of the second five-year plan (1958-1962), somewhat later than in the more industrially developed regions of China. Therefore a large increase in the productivity of agricultural production is of the outmost importance in this region because it will contribute to the industrialization of the Southern Coastal region.

In view of the fact that the southern coastal region lies in the tropical and sub-tropical belts, it is possible to cultivate on its territory not only the usual food and technical crops but many types of tropical and sub-tropical crops and fruit plants. Up to now, little attention was given to this but at the present time the Southern Coastal region is being turned into a huge specialized region of natural rubber production, tropical blast crops, valuable kinds of wood, volatile oil, and fresh fruit and vegetables. This task is all the more important because this region is almost the only region in the whole socialist camp (with the exception of the Democratic Republic of Vietnam) which has the conditions necessary to the production of such important tropical crops as gevey, agave, coffee and cacao.

The Southern Coastal region, which includes the province of Kwangtung, Hainan Island, and the Kwangsi-chuang autonomous region (called simply "Kwangsi" in this report) occupies an area of 445 thousand square kilometers, which is 4.4% of the total area of the country. Most of this region is mountainous and hilly and not very suitable for agricultural assimilation. The most suitable area, in this respect, are the valleys and deltas of the rivers and the plains which stretch along the sea coast. The largest plains are on the middle and lower course of the rivers of the Chu Chiang system, on the strip of sea coast, on Lei-chou peninsula (Lei-chou-pan-to) and in the northern part of Hainan Island.

Almost all of the crop cultivation of the Southern Coastal region is concentrated on the plains. The hilly places and lowlands are only partially suitable for cultivation (mulberry tree orchards, tea shrubs, tung and fruit trees), the higher mountains are not very good for these purposes especially if one considers the particular

requirements of the rice growing economy spread throughout the Southern Coastal region (water for irrigation, terracing, etc.). The Lei-chou peninsula and the northern part of Hainan Island are low basalt plateaus with krasnozem (red earth) soils, on which large masses of virgin land has been prospected. These lands have remained unexploited for a long time mainly because of the large expenditures which would have been needed to uncover and exploit the water sources.

The land in the northern, mountainous section of Kwangsi and also some of the other regions of this province, is made up of lime deposits, as a result of which karstovye phenomena are very developed here; these phenomena can be observed on around half of the territory of Kwangsi, mainly in the western part of the province. In the northern part of the province of Kwangtung, false karst has developed in the thick red sand deposits.

The greater part of the territory of the Southern Coastal region (not including the small islands of the South-Chinese Sea) lies between 26°27' and 18°09' parallels of latitude and has high indices of sun radiation and high temperatures over the whole year. The mountains, bordering this territory from the north and the west, cut off to a large extent the cold dry winter monsoon and also impede the northward movement of the moist summer monsoon which makes the climate mild. Because of this, in the Southern Coastal region, the winter is warmer and the summer cooler than in the regions lying to the north of the Nan Ling range, which marks the northern boundary of the Southern Coastal region.

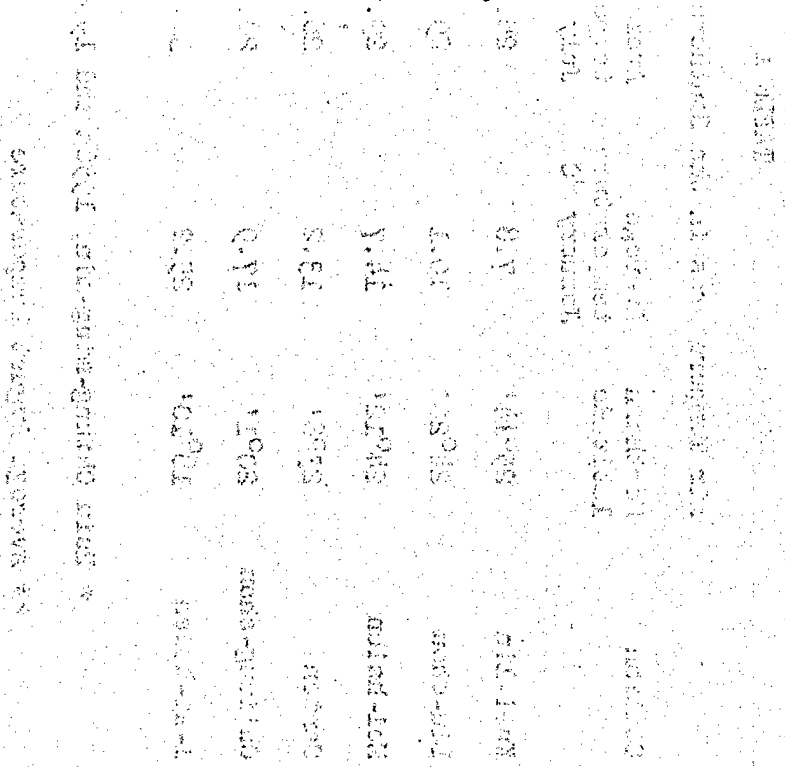


TABLE 1

Air Temperatures in the Southern Coastal Region*

Station	Northern latitude	Average temperature January °C	Average temperature July °C	Yearly amplitude	Absolute maximum °C	Absolute minimum °C
Kuei-lin	25°14'	7.8	28.5	20.7	39.4	-5
Liu-chou	24°20'	10.1	29.1	19.0	39.7	-1.7
Mei-hsien	24°12'	14.7	29.2	14.5	41.2	0.2
Canton	23°8'	13.2	28.7 **	15.5	38.0	0
Ch'iung-shan	20°1'	17.9	28.9	11.0	40.5	6
I-ai-hsien	18°10'	25.2	31.3	6.1	-	-

* Hsiu Chiung-ming-min, 1956a and 1956b

** Average August temperature

Another no less important climatic feature is the large annual precipitation which exceeds 1500 mm in almost all sections of the Southern Coastal region, as shown in the following figures (Hsiu-chiang-ming, 1956b):

Station	Annual amount of rainfall, MM
Kueilin	1947
Liu-chou	1696
Mei-hsien	1590
Canton	1661
Chiung-shan	1501
I-ai-hsien	1642

The mountain slopes with a good exposure according to the seasonal winds and the regions most subject to the action of cyclones and typhoons, get more than 2000 mm of rainfall a year. In the Southern Coastal region, the amount of rainfall is already large in March, most of the annual sum of rainfall occurs in May and June which is very good for the development of agricultural crops planted in the spring. However this region of China is not free from the danger of spring drought, associated with a break in the air circulation regime and a sharp drop in the amount of spring rains. Cyclones and warm convection play a large part in forming the summer maximum rainfall.

Besides the summer maximum, there is also an autumn maximum which occurs in August and September and is caused by the typhoons. These two maximums are separated by the July minimum when the cyclone precipitation is ending and the period of frequent typhoons has not yet begun. During this period only convection precipitation falls. Although as a whole, it brings with it no small amount of rain, in many regions the late rice planting is carried out during this period which requires irrigation.

The inter-relationship of various categories of precipitation in the Southern Coastal region is shown as follows: (according to Lu Ou, 1954)

Cyclonic (frontal) precipitation	62%
Typhoons	21
Convections	17

On Hainan Island most of the rain falls during the autumn maximum; on the mainland, it falls during the summer maximum. After November, polar air masses begin to move south and in the Southern Coastal regions relatively dry weather sets in.

Thus the rainy season, which lasts from April through October, is auspicious for summer sowing. It must also be mentioned that the winter precipitation in the Southern Coastal region is higher than in the other regions of China because in the winter the air masses come here after crossing the Eastern-Chinese Sea and are saturated with moisture; this benefits the winter sowing.

TABLE 2

Distribution of Rainfall over the Seasons of the Year (%) *

Station	spring March-May	summer June-August	autumn Sept-Oct	winter Dec-February
Kuei-lin	38.6	41.3	10.7	9.4
Canton	30.1	46.6	14.2	9.1
Ch'iang-shan	20.0	39.6	33.6	6.8

* Hsiu Chiung-ming, 1956a.

The greater part of the territory of the Southern Coastal region lies in the zone of abundant and adequate moisturization. (Ivanov, 1948).

The zone of abundant moisturization (K 1.50) includes Hainan Island and the greater part of the coastal mainland. The zone of adequate moisturization (K from 1.00 to 1.49) lies between this zone and the zone of moderate moisturization (K from 0.60 to 0.99) and includes the valley of the Hsi Chiang and the central part of Kwangsi.

One other climatic feature of the Southern Coastal region is the large number of typhoons in this region. Around 36% of all the typhoons observed on the whole coast of China occur in this region. The period of typhoons in the Southern Coastal region is prolonged - it lasts from May through November - however the maximum period occurs at the end of the summer and the beginning of the autumn. There is a yearly average of 4-5 typhoons, however from year to year their number varies within the wide limits of from 102 to 10 and more. The typhoons which are associated with strong winds (usually more than 8 points) and intensive downpours, cause a lot of damage to agriculture and to the settlements.

From the point of view of climatic conditions, several investigators (Hsiu Chiung-ming, 1956a and others) divide the territory of the Southern Coastal region into three zones: tropical, sub-tropical and an intermediate zone between sub-tropical and temperate. Beyond the northern border of the tropical zone, the January isotherm is 18°C and beyond the northern limit of the sub-tropical zone the January isotherm is 12°C. However it must be pointed out that such a division is somewhat conditional because recent investigations have shown (Ch'en Ch'an-tu, 1956) that the natural vegetational cover of the whole sub-tropical zone (according to the three zonal division) has many common features with the tropical vegetation (in particular several kinds of palm grown here, the northern limits of which are usually taken to be the northern limits of the tropics.) Therefore the territory of the sub-tropical zone of the Southern Coastal region may be used for growing many strictly tropical crops, particularly inasmuch as the average annual temperatures on almost the whole territory of the Southern Coastal region exceed 20°.

Thus for practical purposes, the territory of the Southern Coastal region may be divided into two climatic zones - tropical and sub-tropical, the border which lies between these two zones corresponds in general characteristics to the northern tropics but has the languages which extend along the river valleys to the north of it. Moreover the tropical and sub-tropical zones, according to the three zonal division, may be treated as part of the tropical zone and the intermediate zone may be considered the sub-tropical zone. South of the limit of the tropical and sub-tropical zones gevey and coconut palms can be grown - north of this limit - oil and arekovaya palm and to some extent, coconut palm, litchi, bananas and pineapples.

Despite the fact that the climate of the Southern Coastal region as a whole is favorable for agricultural production, the spring droughts, and flooding which are brought on by the heavy downpours, the occasional frosts in the northern sections of this territory and also the strong winds, which occur most often during the typhoon season and reach a speed of from 50-60 m a second, frequently cause serious losses. At present a network of special hydro-technical installations, irrigation and drainage systems and a number of wells are being built in order to protect the fields from drought and flooding. During the serious drought in the spring of 1955, many rivers were completely covered over, which made it possible to direct all of their water into field irrigation. In order to protect the fields from the strong winds, protective forest belts are being planted; frost-resistant types of agricultural crops are being introduced capable of withstanding frosts of a short duration.

The Southern Coastal region has a complex river network which is a result of the considerable excess in the amount of precipitation over evaporation and filtration.

These rivers are typified by their depth, duration of summer inundation, the abruptness of fluctuation of the water level, the small size of the steady flow and the large proportionate supply of water.

The main river system of the Southern Coastal region is known by the name of Chu Chiang (includes the Hsi Chiang, Pei Chiang, and Tung Chiang). For its year-round flow, it is only surpassed by the Yangtze and itself surpasses the Yellow River and for the rate of its flow it holds first place among all the rivers of China. The very long duration of summer inundation is due to the long duration of the rainy season. The abrupt fluctuation of the water level is due to the fact that the main rivers and their tributaries are on approximately the same latitudes for which reason the rainy season begins on all of them almost simultaneously. Moreover, these rivers are fan-shaped which means that the water from the tributaries flows simultaneously into the main river causing a sharp rise in the water. This occurrence is aggravated by the absence of large lakes on the lower course of the rivers, which could play an important regulating role.

The silt content of the water of these rivers is not very great and is measured in tens and hundreds of fractions of a percentage whereas on the Yellow River, for example, it attains ten percentages. The Chu Chiang carries no more than 30 million tons of silt a year which is 1.45% of the steady flow of the Yellow River.

The rivers are mainly exploited for irrigating the fields and also for shipping agricultural products. Numerous water retaining installations have been built for irrigating the fields which are connected to the network of irrigation canals. In many cases the water flows onto the fields by means of various mechanical devices. During periods of serious drought, many rivers are completely or partly covered over and their water is used for irrigating the fields. Besides the rivers, water from artificial ponds is used for irrigation; these ponds exist in almost every village; sub-soil water which is extracted by means of ordinary and artesian wells is also used.

The agricultural production can also be helped by properly exploiting the various types of soils existing in the Southern Coastal region, the majority of which are quite fertile (Hsiu Chiung-ming, 1956b). Most of the soils in this region belong to the lateritovyy type (red soil, yellow soil, laterite, and podzol krasnozem). These soils have developed both on acid as well as on basic rock beds. They are distinguished for the fast moving process of soil formation, for the relatively low humus content and for the fact that they are easily subject to erosion in certain sections where there is no forest cover.

The great majority of the soils of the Southern Coastal region belong to the podzol krasnozem type. These soils are common in the regions where the forest cover is maintained or where the forest cover existed a comparatively short time ago. The podzol krasnozem has a brownish color, is rich in humus (4-6%), has a good structure and a higher level of fertility than ordinary krasnozem.

In the regions where the forests disappeared long ago, the soils are covered with occasional grassy or shrubby vegetation, krasnozem is widely developed, the surface layer is usually washed off, the humus content is low (around 3%), the color is light-red, and the fertility is not high. These krasnozem soils are fairly common on the territory of the Southern Coastal region, especially in hilly places and on the small mountains. They are not found on the basalt plateaus; here one finds laterite - ancient soils of a dark red color, which contain iron konkretsii and are very unfertile.

The disadvantage of the krasnozem is that it is quickly destroyed and loses its fertility especially in places with no forest cover and where there is a lot of precipitation. Moreover, they are poor in phosphate in a state accessible to plants. Because of the clay content of these soils, the roots of the plants develop poorly. In view of all of these factors, improvement of the krasnozem soils is one of the most important jobs confronting the agricultural economy of the Southern Coastal region.

Improvement of krasnozem includes a wide variety of measures which lead basically to the following: 1) sowing green fertilizer to increase the content of organic properties in the soil; sowing astragal in the rice growing regions for this purpose as well as sesbania, and special kinds of Chinese radishes, sowing Cajanus indicus (L.) Millsp., on Hainan Island and lespedets in Kwangsi; 2) introducing mineral fertilizers, especially lime and phosphate; lime is very common in the Southern Coastal region and can therefore be had in large quantities; as for phosphate fertilizers, formerly only bone flour was used but now they are beginning to use guano from the sisha islands and phosphorites discovered in the region of Lo-ch'en city (Kwangsi); 3) sowing fodder grasses (cereals and beans) on the steep slopes (15-25°), where ordinary crops will not grow. This will protect the soil from erosion and contribute to the development of animal husbandry and is therefore one of the best ways of exploiting the land in mountainous places; 4) planting forest belts to protect the fields, the water sources and the water sheds and preserving the existing forests; 5) using various crops (tea shrub, camelia, tung, tut, anise, agave and fruit crops) to reinforce the soils; 6) terracing the slopes.

Besides the soils of the laterite type, in the Southern Coastal region alluvial and rice (clay) soils are also common and are found in the valleys and the river deltas. These soils are very fertile and the regions where these soils are most common are the main agricultural resources of this area. On the slopes of the mountain regions, the soils are mostly of the brown forest type and the mountain peaks are more frequently covered with podzol. In the poorly drained regions, gheltozem (yellow soil) has formed in some spots.

The warm moist climate of this region considerably facilitates the implementation of various agro-ameliorative measures. Trees and other plants grow here 2 to 3 times as fast as in the other regions

of China. Consequently, soil reinforcement by means of vegetation and enrichment with organic properties takes less time here and the soils can therefore be improved in a shorter period of time which increases the production of agricultural products.

From all this it may be seen that the natural conditions of this region are very favorable to the task of enlarging agricultural production and assimilating tropical resources.

The land fund of the Southern Coastal region has the following three basic features: 1) a relatively large area of land being worked; 2) a large percentage of irrigated land; 3) a lot of unforested land.

TABLE 3

Distribution of the Land Fund of the Southern Coastal Region*

Region	Total Area million hectares	Cultivated Area		including			
		million hectares	% of total area	water land		dry land	
				million hectares	% of cultivated area	million hectares	% of cultivated area
Kwangtung	22.6	3.7	16.4	3.0	81	0.7	19
Kwangsi	21.2	2.7	12.7	1.8	66.6	0.9	33.3
Southern and Seacoast as a whole	43.8	6.4	14.6	4.8	75.0	1.6	25.0

forests		Forestable land		Wasteland and land unsuitable for agriculture assimilation		Including unused suitable arable land	
million hectares	% of total area	million hectares	% of total area	million hectares	% of total area	million hectares	% of total area
2.7	11.9	7.9	35.0	8.3	36.7	1.8	7.9
1.3	6.1	8.0	37.7	9.2	43.4	0.6	2.8
4.0	9.1	15.9	36.3	17.5	40.1	2.4	5.5

* Hsiu Chung-ming, 1956a; Atlas of the Chinese People's Republic, 1957 and others.

Cultivated land makes up a small part of the territory of the Southern Coastal region. In Kwangtung only 3.7 million hectares are cultivated (16.4% of the whole area of the province) in Kwangsi - 2.7 million hectares (12.7%). Almost all of the plain sections of this region have been put to the plough, and also the foothills and the not so steep slopes of the mountains and hills, which are frequently terraced. The mountains, which cover a large area of the Southern Coastal region, are not suitable for crop cultivation. It is this mountainous aspect of the territory which accounts for the low percentage of cultivated land. However, there is a possibility of extending the cultivated lands by ploughing the unassimilated arable land, of which there is 1.8 million hectares in Kwangtung (7.9% of the total area of the province) and in Kwangsi - 0.6 million hectares (2.8%). If these lands were assimilated, the cultivated area of Kwangtung would increase to 5.46 million hectares (24.2% of the total area of the province) and in Guansi - to 3.33 million hectares (15.7%). In the assimilation of these lands lies one of the possibilities of increasing the production of agricultural products before the establishment of the people's regime, most of these lands could not be assimilated because of the generally low technical level of agriculture and the absence of the necessary financial means in the hands of the peasants. This became possible only after the liberation.

The area of irrigated land in Kwangtung is 81% of all the cultivated land (3 million hectares) and in Kwangsi - 67.5% (1.8 million hectares). This includes 60% of the fields which are irrigated by water from the rivers, 35% by water from the ponds and 5% by means of well water; one third of the water is supplied to the fields spontaneously, whereas two thirds is pumped over the fields by means of various mechanisms (water wheels, pumps and buckets, etc.). The irrigated area is being increased more and more at present as will be shown below. The high percentage of irrigated land makes it possible to cultivate large areas of highly productive crops like water rice.

The lack of forests in the Southern Coastal region is attested to by the fact that forests occupy only 11.9% of the territory of Kwangtung and 6.1% of the territory of Kwangsi. Large stretches of forests, untouched either because of the impossibility of using these areas for crop cultivation or because of the inconvenience of shipping the wood, occupy the whole territory of the Autonomous Region of the Miao and Li nationalities and Ch'ang-an Hsien on Hainan island. Moreover, there are large exploited forests in the northern and western mountainous sections of the Southern Coastal region.

There are large areas suitable for forestration in the Southern Coastal region amounting to around 16 million hectares. Large tree planting operations have been carried out in these regions since 1954.

According to the proposed plan for the development of the agricultural economy from 1956-1967, almost all of the land suitable for tree planting will be forested within this twelve-year period.

The structure of agricultural production in this region is characterized by the high proportion of crop cultivation from which comes the great majority of marketable production. This region specializes in specific types of cultivated crops as well. Food crops, including grain crops and garden (tuber) fruits are the most common crops; unlike the other regions of China (the rice growing regions) here the production of technical crops and fruit crops is more widely developed.

TABLE 4

Proportion of Sown Area under Various Agricultural Crops (%)*

Crops	Southern Sea Board		Northern China	Central China	Eastern China
	Kwangtung	Kwangsi	Ho peh	Huan-a	Chiang-su
rice	67.0	46.1	1.3	41.5	21.3
wheat	7.0	10.2	21.8	11.3	24.8
kaoliang	0.1	0.6	11.3	0.5	3.8
ch'u-mi-ssu & millet	0.4	0.8	22.1	0.17	1.1
corn	0.47	9.5	15.3	1.2	5.3
soy	1.58	2.4	4.1	2.5	10.0
sweet potato	9.5	3.65	2.26	4.4	1.74
peanuts	3.8	3.11	3.6	0.67	1.58
sesame	0.01	0.4	2.4	0.31	1.12
rape	2.5	6.4	0.8	17.2	2.5
tobacco	0.26	0.8	0.33	0.11	0.04
cotton	0.1	0.1	8.8	3.8	6.4
sugar cane	0.8	--	--	--	--

* China Handbook, 1950

The technical crops, which occupy around 10% of the cultivated land, are quite diversified. Sugar cane, jute, rami, peanuts, and tung are the most common. Other specialized crops such as anise, palm, various fruits and cinnamon have been grown for a long time in the Southern Coastal region but before the liberation, the proportion of these crops was very slight.

Thus, the agriculture of the Southern Coastal region has long been characterized by its very unusual selection of cultivated crops and a great diversity of production. Despite favorable natural conditions, this region, under reactionary governments, was not even able to provide its own food and the production of technical crops was on a very low level. For this very reason one of the most important agricultural jobs to be done in this region at the present time is to raise the level of production of both food and technical crops. (See map insert - page 113).

Several characteristic features of the distribution of agricultural crops can be shown. Some of the crops are very common; this applies mainly to the old crops like rice and sweet potatoes. The water rice fields are found wherever there is artificial irrigation but most of the rice production comes from the deltas of the Hsin Chiang and the Han Chiang. Dry rice is grown in the regions where artificial irrigation is complicated by various factors. Sweet potatoes are grown almost all over the mainland of Kwangtung province, in the northern part of Hainan island, in the eastern part of Kwangsi and in the basins of the Liu Chiang and Kuei Chiang. However the main mass of food production (rice and sweet potatoes) comes from the regions situated on the strip of land between the sea coast in the south and the 24° parallel of latitude in the north (including Lei Chou peninsula). This strip also produces most of the sugar cane, many fruits and also spices - cinnamon and anise. Farther south are the tropical regions of the Southern Coastal region including Hainan island, Lei Chou peninsula and some of the regions on the coast of the mainland. This territory is the only place in China where many economically valuable tropical wood crops can be grown (including gevey, coffee, cacao and others). In the regions which lie north of the 24° parallel of latitude, a large part of the coarse grain crops and forest products are produced.

A characteristic feature of the agricultural production of the Southern Coastal region is the peasants' long experience in getting several harvests a year off one unit. This is greatly facilitated by the year-round vegetational period. The average coefficient of yielding capacity for the province of Kwangtung is 1.93, and for Kwangsi 1.8. ("Druzhba" 11 December 1956).

This high coefficient of yielding capacity, which is conditioned by the fact that the sown area is almost twice the size of the plough land, explains the fact that a large amount of agricultural production is taken off a relatively small amount of arable land in the Southern Coastal region (agricultural production is 53.3% of the gross industrial production of industries and agriculture).

The production of food and technical crops is being increased in the Southern Coastal region in three ways: 1) by increasing the number of repeated sowings (increasing the coefficient of yielding capacity); 2) by increasing the output of production from each unit of land and; 3) by assimilating new lands.

The first two methods should be considered the principal means of increasing the production of agriculture because they are being undertaken to increase the harvest of food crops which represent the main mass of agricultural production in the Southern Coastal region. The advantage of increasing the number of repeated sowings lies in the fact that smaller expenditures are required in order to put this into effect than would be needed in order to assimilate the virgin land. The coefficient of yielding capacity indicated (1.93 for Kwangtung and 1.8 for Kwangsi) could be considerably raised. According to the "Basic Situation of the Development of Agriculture in the CPR from 1956-1957", these coefficients will be raised to 2.4-3.0 in Kwangtung and to 2.3 in Kwangsi by 1962. This can be achieved if two harvests of water rice are gathered over the spring, summer and autumn as well as one harvest of some winter grain crop. The winter grain crops should be able to mature from the time the second harvest of summer crops is completed to the time the first-period summer crops are sown. However, up to the present the winter planting has not been carried out in all possible places. In Kwangtung province for instance, 2,466 thousand hectares are suitable for winter planting and only 1,200 thousand hectares are being used so that there are still large reserves here.

The construction of irrigation and protective hydro-technical installations is of great help in increasing the number of repeated sowings and also in combatting droughts and floods. It should be pointed out that under the Kuomintang regimes, the hydro-technical economy of this region was in a state of neglect and the peoples' organizations were therefore forced to expend no small amount of labor and money on the restoration of this branch of the economy.

At the present time hydro-technical construction is being carried out on a much larger scale than could have been predicted. In Kwangtung province, where there is a serious threat of flooding rather than drought, construction efforts have been directed at building protective dams in the deltas and the valleys of the rivers and along the sea coast. During the period from 1952-1956, more than 6000 km. of protective dams (ring-shaped dams, dams on the banks of the rivers and others) were built which made it possible to completely protect more than 933 thousand hectares of fields from flooding. In Kwangsi, where the threat is in the form of droughts, most of the efforts have been directed at the construction of reservoirs and irrigational systems and also at enlarging the area of irrigated land. During the period from 1952-1956, in Kwangsi more than 270,000 large, medium and small irrigational installations were built which improved the water supply on 866 thousand hectares of fields and made it possible to increase the area of

irrigated land by 566 thousand hectares. It also made it possible to replace the dry crops with water rice on the newly irrigated lands and to get two harvests a year instead of one harvest of water rice on the lands where formerly there was an inadequate supply of water. During the struggle against the drought in the spring of 1955, in the Southern Coastal region for the first time the afore-mentioned method of completely covering over the large and small rivers in order to fully utilize their waters for irrigation was employed.

As a result of the operations carried out during the period from 1950-1956, the area of irrigated land in Kwangtung was increased from 59 to 80%, and in Kwangsi from 34 to 66%. Operations to enlarge the area of irrigated land are going to be continued in the future because, in order to get three harvests of grain crops from one section per year, no less than 3.6 thousand cubic meters of water per hectare are needed.

An increased output of agricultural production from the unit of land can be achieved by using more rational methods of cultivation, by introducing new high-yielding seeds, by proper crop rotation, hybridization, seed growing, by raising the fertility of the soils and by fighting agricultural pests and diseases.

Recently the method of thick planting has begun to be used in the rice-growing regions in order to increase the harvest of rice from the unit of land; by this method, the space between the clusters and rows is reduced to 12-20 cm (instead of 26-30 cm) and the number of sprouts in the cluster to 4-6 (instead of 8-12). This method allows for an increase in the number of plants per unit of land. In the delta of the Chu Chiang there is a possibility of giving up bed sowing and transferring to universal sowing on the alluvial soils which would allow for a large increase in the number of plants per unit of land. Since the introduction of this method in the delta of the Chu Chiang, in the short period from 1955-1956, the harvest has increased by 75,000 tons on fields covering an area of 48 thousand hectares; in Kwangtung province, thick planting was introduced on 63% of all the rice fields.

On Hainan island and in western Kwangtung, until recent times, rice was sown onto the fields in the form of seeds. This senseless method of sowing was used in these regions over an area of 166 thousand hectares, and the harvest per hectar was therefore no more than 15 centners. Recently 35,000 hectares of these fields were changed to seedling planting which increased the harvest by 21.6 thousand tons.

As was demonstrated above, the most rational method of growing rice, in the Southern Coastal region, is to plant two successive harvests of rice a year on one section of land; however, up until recently only one harvest of rice a year (or two harvests when sprouts of late rice were planted in between the rows of early rice) was grown on many of these fields. At present these two methods are being replaced more and more by the first which is increasing the productive output. After growing two successive harvests of rice, a third harvest of winter grain crops can be gathered.

Recently, a lot of attention has been given to the introduction of higher-yielding types of rice. "Nan'te" rice, "Che-ch'an No. 9" rice, "Shih-tan-ch'an" and other varieties are being introduced and are yielding a harvest of up to 40-50 centners per hectare. The Korean rice called "Korean-Chinese friendship" yields a harvest 7.5 centners per hectare greater than the ordinary local varieties under the conditions existing in the Southern Coastal region.

Proper crop rotations are very important in increasing the harvest yield of rice. In the Southern Coastal region, in the northern section of the delta of the Chu Chiang and in the delta of the Han Chiang, the following crop rotations are practiced: rice-rice-vegetables, rice-batat-wheat; in the north, east and west of Kwangtung: rice-rice-wheat and the next year rice-batat-wheat or rice-rice-vegetables. In some regions of the Chu Chiang delta and on the Lei-chou peninsula, a rotation of jute-rice is employed. At the present time green fertilizer is being introduced more and more frequently into the crop rotation. However, when two to three harvests are being gathered a year from one section, the soils are seriously exhausted and green fertilizers alone are not adequate to maintain the fertility at the required level. Therefore, it is absolutely necessary to introduce a large amount of other types of fertilizers in order to get reliable harvests. Under the people's regime, chemical fertilizers, guano and also bone flour which was used formerly, are being used more and more but up until now the basic types of fertilizer are still silt, rice chaff, manure, garbage, bean oil-cakes, etc. Gathering and accumulating various types of fertilizers has become a national movement at the present time as a result of which the amount of fertilizer introduced into the soil has increased considerably.

According to the plan for developing agriculture, it was predicted that an average grain crop harvest of 60 centners per hectare would be reached by 1967, however this level has already been achieved and in many hsiens, the more advanced producers are gathering up to 75 centners of rice per hectare and more. There have been instances of record harvests of 117 centners per hectare and even 151 centners per hectare.

As a result of all these measures, rice production in the Southern Coastal region had increased to 16,882 thousand tons in 1957 as opposed to 10,670 thousand tons in 1945.

The production of the second most important food crop of this region - batat - is being increased by more or less the same methods as rice production. Batat is not only an important food crop but also a valuable fodder and technical crop (it is used for livestock feeding and for producing alcohol and starch). Under the conditions existing in the Southern Coastal region, it can yield from two harvests a year (in the north) to four harvests a year (in the south). As a result of the increased coefficient of yielding capacity, the area sown to batat grew enormously. In 1947, 402 thousand hectares were sown to batat in

Kwangtung and in 1955 this area had increased to 866 thousand hectares. In Kwangsi, 340 thousand hectares were sown to sweet potatoes in 1955 as opposed to 120 thousand hectares in 1947. Agro-technical improvements are increasing the sweet potato yield. In 1956, in Ch'ao-yang Hsien, several food cooperatives gathered a batat harvest of around 850 centners per hectare as opposed to the usual 60-70 centners per hectare. However, still greater prospects are promised by the method of crossing sweet potatoes with bindweed, ("moon flower"), because this method makes it possible to get up to 1,500 centners of sweet potatoes per hectare.

These great achievements in increasing the food production made it possible to produce up to 326 kilograms of food per person in Kwangtung in 1957 (as opposed to 225 kg. in 1951) and in Kwangsi - up to 506 kilograms (as opposed to 287 kg. in 1952). In 1958 there was an average of 550-600 kg. of food per person (grain, garden fruits).

Unlike the food crops, production of basic technical crops and fruits is being increased by virgin land assimilation and only partly by increasing the harvest yield and by introducing technical crops into crop rotation with food crops. This is explained by the fact that the majority of these crops require much more time for full maturation than the food crops and therefore the yield coefficient cannot be raised to a great extent, particularly inasmuch as there are quite a few perennials among these crops.

Explorations undertaken recently in the Southern Coastal region have uncovered large masses of virgin land, of which more than 300 thousand hectares have already been assimilated. Virgin land assimilation has been carried out by means of peasant labor, organized into food cooperatives, and also by settler-volunteers who have come here from all parts of the country. A good deal of assistance has also been given by the state farms, machine tractor stations and experimental stations. Virgin land on the Lei-chou peninsula and on Hainan island is being assimilated particularly intensively; around two thirds of all the virgin land in Kwangtung suitable for ploughing is concentrated here. Virgin land occupies a fairly large section on the basalt plateaus. One defect of these territories is the fact that in many sections, there is not enough surface water because the river beds are so deep; the assimilation of these lands therefore depends on exploration of sources of artificial irrigation mainly artesian chinks. The soils here are predominantly krasnozem, although in some places one can find zheltozem and alluvial soils. The natural vegetational cover in these regions is of the Savann type. The most profitable crops here are tropical bast crops, palm, coffee, pineapple and some gevey.

A total of 1.76 million hectares arable virgin land may be assimilated in Kwangtung and 0.63 million hectares in Kwangsi. The visible achievements in virgin land assimilation since the liberation of the Southern Coastal region are shown in Table 5.

TABLE 5

Increase in the area of cultivated land in the Southern Coastal region in 82 years (% of 1873 level)*

Year	Province	
	Kwangtung	Kwangsi
1873	100	100
1893	101	105
1913	101	117
1933	102	123
1948	102	123
1956	145	166

* China Handbook, 1945, 1950; Hsiu Chiung-ming, 1956a.

A large part of the newly assimilated lands is being planted to tropical and sub-tropical technical crops and also to fruit trees.

All of the technical crops of the Southern Coastal region may be divided into annuals (peanuts, jute, tobacco, beans, rape, and sesame) and perennials (sugar cane, agave, rami, castor-oil plant, tung, tuta, long-boll cotton). Some of these crops are summer crops and some are winter crops. Some of the crops occupy plough land (sugar cane, jute, peanuts, tobacco and others) and some grow on unploughed land (gevey, coconut palm, tea shrub, agave, pineapple, fruit trees and others).

Such a variety of technical crops makes the problem of enlarging their production very complicated and demands a careful and many-sided approach. The extent of the area under various technical crops must not be increased at the expense of food crops and the technical crops and fruit trees should be planted mainly on land which is not suitable for planting food crops. Increased production of the most valuable tropical technical crops takes precedence over other technical crops.

One of the most important technical crops in the Southern Coastal region is sugar cane; this crop is of nation-wide importance because this region is now the main producer of sugar cane in the country. Sugar cane has been grown in this region since ancient times but during the Japanese occupation, this branch of agricultural production suffered. After the victory over Japan, the KMT rulers could not change the existing situation and the people's regime therefore had to work very hard to restore the sugar cane production after the liberation. The production of sugar cane has grown in two directions: first, by increasing the area

planted to it and second, by raising the yield by means of improved agro-technology and by the introduction of highly productive varieties; better fertilization and other methods have also contributed here.

The increase in the area planted to sugar cane is illustrated by the following figures (Hsiu Chiung-ming, 1956a):

Years	Areas planted to sugar cane, thousand hectares.
1950	35.3
1951	52.0
1953	57.3
1954	73.3
1955	84.0
1956	110.0
1957	164.0

Of major importance in increasing the yield of sugar cane has been the replacement of the old varieties which had a low sugar content with new improved ones ("Javanese large stem", "Javanese 2870", "Javanese 3016", "Taiwan 134", "Taiwan 188" and others). Inasmuch as sugar cane is mainly planted on the slopes of the hills and requires a good deal of water, the problem of irrigating the fields planted to this crop has also assumed an important role in increasing the yield. No less important are correct crop rotations. Whereas in 1946, 105 centners of cane were gotten from one hectare, in 1954 it was already up to 525 centners per hectare and by 1955 the yield in some cases was as high as 1050 centners per hectare.

The problem of increasing the production of oil crops is somewhat more complicated. In the Southern Coastal region until now, there has been a lack of nutritional vegetable oils from local production, most of which come from peanuts. In the best years more than 211.8 thousand tons of peanuts were produced here, in 1952 only 190.2 thousand tons were produced. It would seem that the peanut production could be considerably increased by enlarging the area planted to it but it must be remembered that peanuts is a summer crop and that an inordinate increase in the area planted to it could prevent an increase in the area planted to batat and other food crops. Therefore, according to the plan, the production of peanuts will only be increased to 344.6 thousand tons by 1957 which is 81.2% more than the 1952 level.

It is now considered more rational to increase the production of another important oil crop - rape - which, unlike peanuts, is a winter crop and although it is not as widespread as peanuts, an

extension of the area sown to it would not prevent an increase in the production of other crops. Therefore the production of rape should yield twelve times as much by 1957 as compared with 1952.

Production of the main fibrous crops such as jute and rami is being increased by enlarging the area planted to these crops; jute is now being grown in crop rotation with food crops which also increases its level of production.

The measures which have been carried out have already considerably increased the level of agricultural production in the Southern Coastal region which has substantially surpassed the 1952 indices in all the basic types of crops.

TABLE 6

Growth of agricultural production in the Southern Coastal region during the first five-year plan (in thousand tons)*

Crops	Kwangtung		Kwangsi	
	1952	1957	1952	1957
Food crops	8850	13500	5050	9600
Sugar cane	2940	6000	400	2000
Bast crops	18	83	-	-
Oil crops	165	330	-	-

* Hsiu Chiung-ming; materials from the newspaper "Jen-min Jih-pao" for 1957.

REMARK: The planned data has been presented for 1957 with corrections in accordance with actual plan fulfillment.

*

Although an increase in the production of food and technical crops is the main task which stands before agriculture in the Southern Coastal region, no less important is the problem of enlisting specialized wild and cultured plants of the tropical belt into the economic turnover. These crops are of great economic value; this problem may be called assimilation of the tropical resources of this oblast. Among the most valuable crops in this category are gevey, agave, Manilla hemp, long-fiber cotton, palm, castor-oil plant, cacao, coffee, wild grass, and various fruits. The forests of the tropical zone of the Southern Coastal region are also rich in valuable types of trees including hard species, rubber trees, mangry, etc.

Formerly only certain fruit trees (litchi, lun-yen, banana and citrus) were utilized economically as well as trees yielding spices (black pepper, anise, and kassiya) and ones which were exploited for technical purposes (bamboo, camphor laurel, etc.) however, they were exploited on a very small scale.

It should be mentioned that many tropical plants do not require plough land and are content with land not suitable for ploughing - the mountain slopes, etc. This is very important to the problem of utilizing unexploited territory which is especially numerous in the mountainous locales. Many tropical crops can be grown in areas where it was formerly believed impossible. In the past, many Chinese and foreign scientists believed that the great majority of strictly tropical crops could (and even then not always) only be grown on Hainan island and on the Lei-chou peninsula. It was also thought that many of the tropical plants like gevey could not acclimatize to China because of the absence of prerequisite climatic conditions (they had in mind the insufficient rainfall, the cold waves and the strong winds). This opinion was strongly supported by the foreign imperialists who would not have profited by Chinese competition in the production of natural rubber, tropical bast crops and other important types of raw material.

Recently Chinese scientists have carried out a series of investigations (Ch'en Ch'ang-tu, 1956 and others), as a result of which it was proven that the formerly held opinion was not always correct. It was customarily thought that Hainan island had the right climate for wet tropical forests and that the southern sections of the provinces of Kwangtung and Kwangsi had a sub-tropical forest climate. However these investigations proved that tropical plants such as mangroves, were common farther north, almost to the city of Hsia-min, that arekovaya palm is found in huge natural groves in the south-eastern section of Kwangsi and is now grown even on the coast of Fukien province, that tropical fruits - litchi, bananas, papaya and others - grow in the northern section of the southern half of the Southern Coastal region. In Kwangsi in the region of the city of Pa i-ssu, the vegetation closely resembles the wet tropical forests. Naturally on the mainland certain characteristics typical of tropical vegetation (such as the variety of plants, visible roots, etc.) are less clearly expressed than they are on Hainan island but nevertheless, there exists a good basis for claiming that all the regions of the Southern Coastal region which lie south of the tropics and also part of the regions north of the tropics (along the river valleys) belong to the tropical zone and also good reason for cultivating not only sub-tropical wood crops but also tropical ones. The contention that gevey and certain other tropical crops of non-Chinese origin cannot be grown in China has also been refuted. At present gevey is successfully acclimatized not only to Hainan island but also to the mainland. Madagascar "travellers' tree" and many other crops are also acclimatized. In view of the great extent of the territory of the Southern Coastal region and its diverse sections, there are many specific local features, and the crops can be varied according to the section to which they are best suited. On the basis of local physical-geographical differences in various sections of the Southern Coastal region, Chinese scientists (Ch'en Ch'ang-tu, 1956) recommend the following crop distribution:

Hainan Island: On the north-eastern seaboard where the climate is hot and humid, it is recommended that coconut palm, pineapple, agave and sugar cane be grown. In the south-eastern section of the island where the climate is hot and relatively dry, coffee and coconut palm are best suited; in the south-western section where the climate is dry and there are strong winds, it is recommended that long-fiber cotton and agave be grown; in the north-western section where the winter season is long and dry, agave, pomerantsevaya grass, sugar cane, and coffee can best be cultivated. In the central and western section where there is a mountainous relief and a humid climate coffee, oil palm and Manilla hemp are best suited.

WESTERN SECTION OF KWANGTUNG PROVINCE AND THE SOUTHERN SECTION OF THE LEI-CHOU PENINSULA: These oblasts have a damp hot climate and high quality sugar cane, coffee and pineapple can be grown here. On the plateau, which lies north of Hai-k'an city and south of the line which crosses the cities of Mao-ming, Hua-hsien, Lien-chiang, P'u-pei, and Ch'in-chou, it is recommended that agave and sugar cane be grown - on the hills and in the foothills north of these points - oil camelia, and coffee and in the mountains - anise. This crop distribution serves the differences in moisturization in the different sections of this territory (from 1250 to 2000 mm a year), the difference in the relief of these sections, the varying degree of accessibility of water sources, the presence of krasnozem in some sections (Lei-chou peninsula) and alluvial soils in others (Pei-hai Hsien).

EASTERN AND CENTRAL SECTIONS OF KWANGTUNG PROVINCE: Here most of the land is assimilated and there is very little virgin land. It is recommended that lun-yen and citrus fruits be grown in this region; the high degree of moisture, high temperatures and fertile soils with an adequate amount of water are favorable for these crops. These crops should be grown primarily on the slopes of the hills.

SOUTHERN AND SOUTH-EASTERN SECTIONS OF KWANGSI: In these hilly regions the most suitable crops are pineapple, agave, jute, tut, castor-oil plant, litch; lun-yen and citrus fruits; along the rivers sugar cane and bananas can be grown, in the south-western mountainous section--medicinal plants. This region used to be considered completely unsuitable for growing many of these crops, however, the natural conditions here are entirely suited to them.

As was pointed out earlier, the territory of the Southern Coastal region is very unforested, however, the existing forest masses provide quite a lot of wood products. The forests of the sub-tropical belt, which are located in the northern mountainous sections of this region, yield mostly commercial timber (pine, kunningamiya) whereas the forests on Hainan island yield tropical wood products. Of greatest economic importance is construction and commercial timber - pine, kunningamiya, chestnut, maple, oak; the species which yield various types of industrial raw materials - tung, cork-oak, varnish-tree, bamboo, gevey; the species which yield food products - palm, fruit trees, etc.

Forest planting is pursued mainly for improvement purposes: to afforestrate the water sheds, to regulate the river flow, to establish field protective strips, to fight soil erosion, etc. However, another goal is achieved through forest planting - the area planted to the most valuable wood species is increased.

CONCLUSION

It should be said that even in the presence of so many favorable factors, the problem of increasing agricultural production and exploiting tropical resources could not be solved without the implementation of extensive socialist reforms in the city and in the country which provide a strong stimulus to the development of productive forces in the new China.

Despite the fact that the Southern Coastal region was liberated at a later time than the other regions of China, agrarian reform was immediately instigated here, as a result of which many millions of peasants received land. However, it was impossible to think of realizing an extensive and stabilized increase in agricultural production on the basis of small individual peasant holdings because under these conditions, it was impossible to increase to any extent the productivity of peasant labor, to mechanize agricultural operations, to assimilate new lands, to improve the fertility of the soils, or to combat natural catastrophes. Therefore, after extensive political work had been done among the peasants, since 1953 a massive movement to unite the peasants into agricultural productive cooperatives has been under way. Cooperization was implemented on a planned basis observing the principal of free will.

After the completion of cooperization, in 1958 a movement to establish peoples' communes began to develop; almost all the rural countryside has now been taken over by these communes. This stimulated, to an even greater extent, the development of agriculture in the Southern Coastal region. In this region, a system of state farms has now been set up, these farms are equipped with modern technology; machine tractor stations, experimental farms and agro-technical points have also been established.

All of these measures have eased the fight against natural catastrophes and have made it possible to gradually improve the technological equipping of agriculture, to introduce progressive experimentation and raise the fertility of the soils. The state farms and machine tractor stations play a major role in the assimilation of virgin lands, in developing plantations and also in circulating advanced methods in agricultural work. The experimental farms and agro-technical points, besides their experimental work, are helping the peasants to conduct their work in accordance with the requirements of modern agro-technological science and familiarizing them with the experience acquired in the Soviet Union.

Industrial growth in the Southern Coastal region is contributing a good deal to the solution of these problems. The light and food industries are in the first rank as far as development is concerned; these are the branches of industry which are concerned with processing agricultural raw material and producing consumer goods. The growth of these branches of industry is enlarging the sale of agricultural production and thereby stimulating the development of agriculture. On the other hand, an increase in industrial production is making it possible to satisfy the needs of the peasantry in agricultural equipment and consumer goods.

At the present time intensive road construction is being carried out in the Southern Coastal region which is stimulating the development of agricultural production by providing an outlet for agricultural products to consumer points and by facilitating the delivery of consumer goods to rural locales.

The solution of these problems which will enlarge the agricultural production and exploitation of tropical resources in this region, is determining the productive specialization of the Southern Coastal region in the present and near future as the main economic region for the production of valuable tropical crops in the country.

BIBLIOGRAPHY

Atlas of the Chinese People's Republic, Peking - Shanghai, 1957 (in Chinese).

Ivanov, N. N. Landscape-Climate zones of the globe. Moscow - Leningrad, 1948 ("Western All-union Geographical Situation", new series, Vol. 1).

Lu Ou. Climate of China. Shanghai, 1954 (in Chinese).

Liang Jen-ts'ai. Economic Geography of Kwangtung. Peking, 1956 (in Chinese).

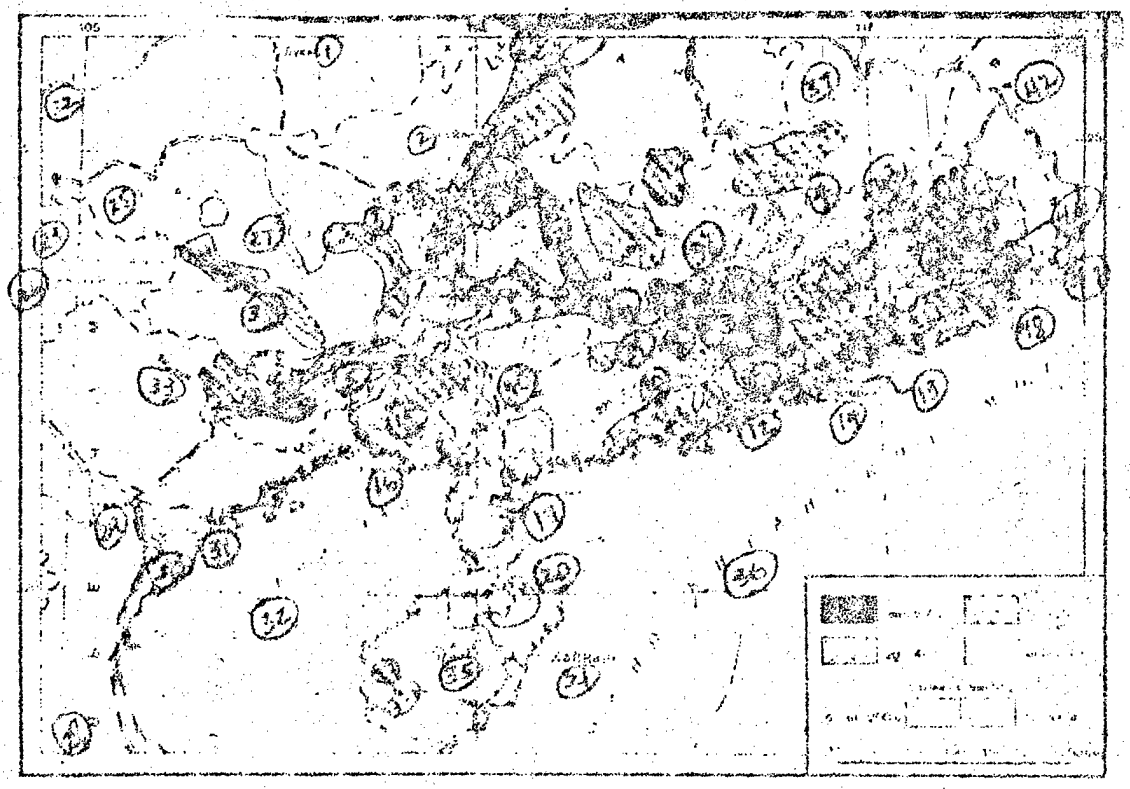
Mao Tse-tung Problems of Cooperization in Agriculture. (Report to the Council of Secretaries of the Provinces, State and Oblast Committees of Communist Party of China, 31 July 1955) Moscow, 1955.

The Basic Position of the Development of Agriculture CPR in 1956-1957 (proposed plan). Supplement to the magazine "Druzhba", 1957, No. 7.

Projected 7 year plan for agricultural construction in Kwangtung. Canton, 1956 (in Chinese).

Decision of the sixth (general) Plenum of the CC CPC of the Seventh Session of the Problem of Cooperization in Agriculture. Adopted on 11 October 1955 in a report by Comrade Mao Tse-Tung, presented at the Council of Secretaries of Provinces, State and Oblast Committees of the Communist Party of China 31 July 1955, Moscow, 1956.

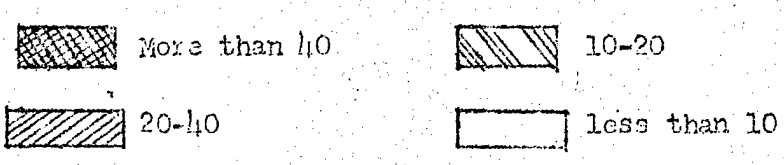
Hsiu Chiung-ming. Geography of Kwangtung-Kwangsi. Shanghai, 1956a (in Chinese).
Hsiu Chiung-ming. Physical-geographical features of Kwangtung. "Chung-shan Ta-hsueh Hsueh-pao", 1956b, June (in Chinese).
Ch'en Ch'ang-tu. Assimilation of the Tropical Resources of Southern China. "Ti-li Chih-shih", 1956, No. 1 (in Chinese).
Buck, J. L. Land Utilization in China, 1937.
China, Handbook. 1945, New York, 1945.
China Handbook. 1950, New York, 1950.



Ploughland on the territory of the Southern Coastal Region
(in percentages)

Legend to Map

1. Tu-yun
2. Kuei-lin
3. Lin-chou
4. Shao-kuan
5. Nan-ning
6. Wu-chou
7. [Not used]
8. Chiang-min
9. Fei-shan
10. Hsin-ho-i
11. Chung-shan
12. Ao-min
13. Chin-lung
14. Victoria
15. Ho-nu
16. Pei-hai
17. Chan-chiang
18. [Not used]
19. [Not used]
20. Hai-K'ou
21. Hainan Island
22. Kweichow Province
23. Yunan Province
24. Hunan Province
25. Kwangsi Chuang Autonomous Region
26. Tropic of Cancer
27. Mung-shui Ho
28. Vietnam
29. Hanoi
30. Red River
31. Haiphong
32. Gulf of Tonking
33. Li Kiang
34. Hsi-yang Kiang
35. Nan-tu Ho
36. South China Sea
37. Kiangsi Province
38. Pa chiang
39. Hsi Kiang
40. Yui-lin
41. Canton
42. Fukien
43. Tung Kiang
44. Han Kiang
45. Chao-an
46. Tse-yang
47. Shan-t'ou
48. Ch'ao-yang



scale of elevations

V. Development of Crop Cultivation in the Sinkiang Uighur Autonomous Region of the Chinese People's Republic

by Ya. M. Berger

Crop cultivation is the most important branch of the economy of the Sinkiang Uighur Autonomous Region. Four-fifths of the population of this region is occupied in crop cultivation and this branch of the economy yields around one half of the gross production of the national economy and three times as much as animal raising. The basic mass of food and forage products and raw material for the light industry are produced by crop cultivation.

The development of cultivation in Sinkiang is characterized by many particular features which have to do with the natural conditions and with the history of the development of the national economy. These features have developed out of the relatively limited fund of arable land and the extremely important role which is played by artificial irrigation and in an oasis type of cultivation.

Land and Water Resources and Increasing the Arable Fund

Most of the territory of Sinkiang is either desert or extremely mountainous formations unsuitable for agricultural assimilation. In the huge expanses of southern Sinkiang, which stretch from the southern foothills of the Tien Shan to the northern foothills of the Kunlun and the Altin Tagh, lie the completely uninhabited sandy stretches of desert called the Takla Makan. The area of this desert covers 360 thousand square kilometers which is almost one half of the area of Southern Sinkiang and one fifth of the whole territory of this oblast. The deserts in the northern part of Sinkiang-Dzungaria have been greatly developed. The central section of the Dzungaria hollow is covered with sandy deserts and the borderland sections are clay-salt and rocky deserts.

Over a 2250 kilometer wide area within the limits of Sinkiang stretch the mountain chains of the Tien Shan, the distance between them is 150-300 kilometers. The mountain ranges of the Mongolian Altai, Kunlun, Altin Tash range and many others enclose the territory of Sinkiang and occupy a large area along its borders.

Almost all the suitable arable land is concentrated in a small strip at the foot of the mountains bordering on the Tien Shan and the Kunlun and also in the lowlands between the mountains of the Tien Shan.

Agricultural oases alternate with desert in the foothill strip. The oases are departed from each other by tens and even hundreds of kilometers. Around two thirds of all the arable area of this oblast is concentrated in the oases of southern Sinkiang and is irrigated by the rivers of the Tarim river basin. The largest oases are in the

western half of this section of Sinkiang. The mountainous frame reaches an absolute elevation here of 6000-7000 meters which results in many glaciers and in very deep rivers which can irrigate larger areas than in the east. However the area of even the largest oases - Kashgar and Yarkend - is only a little more than 2 thousand square kilometers. Only around 30 oases in southern Sinkiang are larger than 50 square kilometers; all of the other oases are much smaller. The total area of oases in the Tarim basin is 15 thousand square kilometers (Course in the Economic Geography of China, 1956), which is only 1/60 of the territory of this basin.

In Sinkiang there are still large untouched masses of potentially arable land. In most cases this land can only be exploited by more or less complicated measures and, above all, by a considerably amount of irrigational construction. For this very reason the assimilation of this land was impossible under the feudal system. Under the people's regime, assimilation of virgin land has become one of the most important prerequisites to the agricultural development of this region.

An important feature of the climate of Sinkiang is the large amount of rainfall. The Tarim hollow, which is almost completely inclosed from all sides by high mountains, gets less than 100 mm of precipitation a year. In the Dzungaria hollow, which is open on the north-west, a little more precipitation falls - 100-250 mm a year but even this amount of precipitation is too little for crop cultivation. The spring is particularly unfavorable in this respect, when the agricultural crops are in greatest need of moisture and the amount of precipitation is inconsequential or practically non-existant. For this reason agriculture in Sinkiang is almost exclusively conducted on water land. The only region where bogarnoye agriculture is quite well-developed is the basin of the Ili river. In connection with this one important condition for enlarging the arable fund of Sinkiang is complete and rational exploitation of surface and sub-soil water resources.

The new Sinkiang inherited from the past an extremely incomplete irrigational network and backward methods of watering the fields. Most of the canals do not have water-retaining installations; as a rule they are covered over by a so-called "shporoy" (spur) - a ridge of stone and clay which supports a wooden tri-pod (trenoga) - "sipay". When the water level on the river is low, it does not run into the canals and during floods it can easily break the simple obstacles, wash out the canals and inundate the fields. The local population built no reservoirs up until recent times and the winter water was therefore not used at all while the summer water was to a large extent uselessly wasted. The water was supplied to the fields simply by letting it pour onto them which frequently raised the sub-soil water level and resulted in salting and swamping. The loss of water by filtration into the canals was very great; it was as high as 3% of the total outlay of water per one kilometer of canal.

By improving the existing irrigational networks and methods of irrigation and also by building reservoirs for regulating the flow, it will be possible to exploit the large water resources for increasing the arable area.

The total annual flow of rivers and springs in Sinkiang is valued at 70 billion cubic meters. (Economic Situation of the Sinkiang Uighur Autonomous Region, 1957) including more than 60 billion cubic meters in the rivers. The areas into which this flow feeds are distributed as follows: Tien Shan -70%, Kunlun - 16%, Altai - 11%.

If it were possible to utilize all of this water for irrigation, considering the fact that the irrigated norm under Sinkiang conditions (including losses to filtration) is around 9 thousand cubic meters, it would be possible to increase the arable area of Sinkiang from 1.6 to 8 million hectares, as a number of authorities have demonstrated (Economic Situation of Sinkiang Uighur Autonomous Region, 1957 and others). But all of this flow cannot be used for irrigational purposes inasmuch as part of it apparently cannot be regulated (because of an absence of proper conditions for building reservoirs or for other reasons), moreover, part of the water is needed for supplying the growing industry and cities after which it is no longer any good for watering the fields. Experience in the Central Asian republics testifies to this: in the Syr Darya basin - one of the main agricultural regions of the Central Asian USSR - 46% of the flow is being used at the present time for irrigation, in the Amu Darya basin - only 19%. Existing plans for developing irrigation in the first of these regions proposes utilization in the future of 93% of the water resources, and in the second - 59% (Uzbek SSR, 1956). Thus, in all probability, the area which can in fact be irrigated and included in the crop rotations will prove to be less than 8 million hectares. All of the virgin land masses in Sinkiang which are accessible to water are very large and will make for a large increase in the arable fund.

The assimilation of virgin land in Sinkiang has been carried out on a large scale since 1950. Many reservoirs and irrigational canals have been built to this purpose: in the suburbs of Urumchi, in the Manas river basin, in the Khama oases, Karashar, Kurlya and Aksu. During the first five-year plan (from 1952 to 1957) the sown area of Sinkiang grew from 1100 to 1600 thousand hectares. ("Sinkiang Jih-pao" 13 March 1958).

Assimilation of virgin land during the first five-year plan was carried out mainly north of the Tien Shan. During this period almost 60% of all the new land was assimilated on the foothill plain which is irrigated by the rivers of the northern slope of the Tien Shan. Land assimilation was very intensive in the region which lies north of Urumchi - in the Manas basin. The southern foothills of the Tien Shan and the valleys which lie between the mountains were assimilated to a lesser degree during this period. In the rest of Sinkiang, there was no virgin land assimilation or it took place on a very small scale.

During the second five-year plan virgin land assimilation will be carried out both in the north and in the south of Sinkiang. The main regions for land assimilation will be the region of Aksu (the middle course of the Tarim river), the region of Lake Bagrach Kol and the Konchedari river (the lower course of the Tarim). North of the Tien Shan, the land will be assimilated at approximately the same rate as during the first five-year plan. Increased land assimilation in southern Sinkiang is attributed to the fact that the newly organized state farms there frequently specialize in cotton growing and the cotton growing conditions in southern Sinkiang are considerably better than in the north.

In order to assimilate the virgin land in Sinkiang many obstacles must be surmounted. Frequently, the sub-soil water lies very close to the surface on the newly assimilated lands. The rise in the level of the sub-soil water makes it more difficult to combat the reed which is an extremely dangerous weed on the fields. Frequently the wheat sprouts and even the sprouts of the ploughed crops like cotton and corn are completely smothered by the reed in the Manas basin. Where wheat grows together with reed, a combine cannot get through; the wheat must be harvested either with horse-drawn reaping machines or by hand with sickles.

There is another menace in a rise in the level of sub-soil water. This is the secondary soil salting process. Large areas of arable land are excluded from the crop rotation each year because of this salting process. From 1950 through 1957, the state farms abandoned 23 thousand hectares of plough land. ("Sinkiang Jih-pao" 4 April 1958). The increased salt content in the soil leads to a sharp decline in the yield of agricultural crops. In order to reduce the salt content, the state farms are practicing soil washing. Proper land organization and the introduction of crop rotation are very important in this respect.

In connection with all these factors, proper organization of drainage is of great importance in Sinkiang. Lack of experience in performing drainage operations sometimes leads to a rise of the sub-soil water level after the virgin land has been assimilated. The size of the areas with deep-lying sub-soil water is reduced and the sections with sub-soil water close to the surface grow larger. Thus for example, on the Pobeda No. 1 state farm near the city of Aksu, there were absolutely no lands in 1954 with sub-soil water at a depth of 1-2 meters, whereas in 1956 this area had increased to 1.5 thousand hectares. Before the virgin land had been ploughed up on the territory of this state farm, the area of land with sub-soil water at a depth of more than 8 meters was 1.5 thousand hectares, as the present time - it is only 33 hectares. This process can also be observed on the state farms in the Manas basins and in other regions.

Most of the virgin lands can be exploited only for water cultivation, but some of the virgin land does not require artificial irrigation.

Experience has shown that bogarnyy cultivation is entirely possible in the basin of the Ili river, in the region of the Mongolian Altai and on the northern slopes of the Tien Shan. In the valleys of the Kash and the Tekes, conditions are particularly favorable for this type of crop cultivation. More than 400 mm of precipitation falls a year here and the yield of bogarnyy crops is therefore relatively high and reliable. In the other regions of the Ili basin around 300 mm of rain falls and the annual fluctuation of the rainfall is comparatively small (a deviation of 15-20% of the yearly norm). Nevertheless the fluctuations in the spring and summer rainfall (April-June) can reach large proportions (up to 40%.). The yielding capacity therefore fluctuates here a great deal: from 10 to 45 centners per hectares in the most fruitful years and less than 4 centners per hectares in dry years. It must be kept in mind, however, that capital investments in bogarnyy cultivation are considerably less than in water cultivation and for this reason even with such large fluctuations in the yielding capacity, bogarnyy cultivation is profitable.

At the present time it is difficult to accurately evaluate the area suitable for bogarnyy crops because no detailed soil survey has been made. Nevertheless, investigations carried out by a group of workers at the Sinkiang Scientific-Research Institute of Agriculture and Forestry have shown that in the K'u-lo'chin Hsien alone the area suitable for bogarnyy cultivation is no less than 60 thousand hectares. (Report on the Investigation of Bogarnyy Cultivation in the Basin of the Ili River, 1957). This is almost equal to the present area of bogarnyy crops in the whole Ili basin. From this it is apparent that, despite the fact that the main type of crop cultivation in Sinkiang is water cultivation (the area of bogarnyy crops is around 70 thousand hectares or a little more than 4% of all the sown area); there is still a great potential here of increasing the area sown to bogarnyy crops. The assimilation of virgin land represents one of the chief ways of developing agriculture in the Sinkiang Uighur Autonomous Region, and of increasing its food and raw material base.

Development of the Grain Economy

Besides enlarging the plough land by assimilating virgin lands, of enormous importance in the development of the food and raw material base in Sinkiang are measures directed towards a more intensive exploitation of existing plough land. Some of these measures are improved agro-technology, increasing and regionalizing the most fruitful crops and varieties of crops, increasing the area sown to repeated sowings.

Agro-technology in old Sinkiang was on a very low level. The main agricultural tools were the ketmen and the wooden plough. Fertilization was hardly practiced at all, the fields were not weeded, the seeds were strewn onto the ground and frequently ploughing followed sowing rather than preceding it.

The introduction of agrarian reforms and the formation of cooperatives from the small peasant farms along with the establishment of state farms, has made it possible to improve agro-techniques to a great extent. In recent years modern agricultural techniques have become common in Sinkiang. Tractors and combines are now available mainly on the state farms but the peasants are using ploughs with double plough shares, row seeders, automatic harvesters and other equipment on a broad scale now. Already in 1956, more than half of all the plough land in Sinkiang was ploughed with modern ploughs and the depth to which the land was ploughed increased a great deal. Most of the corn and a lot of the wheat is sown by the row method. The use of fertilizers increased considerably, particularly manure and duvalnoy ash. The crops planted on plough land are fed all over Sinkiang. The care of crops has improved: the sprouts are thinned out; the crops are cultured and the weeds are removed. Poisonous chemicals are being used more and more extensively in the country against agricultural pests.

Of particular importance to Sinkiang has been the introduction of high yielding types and varieties of agriculture crops which are better suited to local conditions.

In the agriculture of Sinkiang, grain crops occupy a very important position. They make up 80% of sown area. The principal grain crop is wheat which occupies 42% of the whole sown area and yields 44% of the grain. Up to 1949, spring wheat far surpassed winter wheat. In recent years spring wheat sowings have not changed very much but the area sown to winter wheat has grown steadily and quickly. From 1949 to 1955 winter wheat sowing quadrupled. ("Sinkiang Jih-pao" 5 October 1955 and 14 June 1956.). As a result of this, the share of the sown area sown to spring wheat was reduced from 32.2 to 22.8% in the period from 1949-1955 and the share of winter wheat grew from 7.9 to 19.2%. In 1955 winter wheat yielded more grain than spring wheat.

Experience has shown that winter wheat can be grown almost everywhere in Sinkiang with the exception of the very far northern region of the Mongolian Altay. In northern Sinkiang it can withstand the severe winter because of the deep snow cover and in southern Sinkiang, where the climate is more mild, winter wheat withstands the winter even without the snow cover. In almost all of Sinkiang (with the exception of a few regions in the basin of the Ili river and parts of the oases on the northern slope of the Kunlun) the yielding capacity of winter wheat is higher than that of spring wheat and for this reason the substitution of winter wheat for spring wheat has played an important role in the increased production of grain. Moreover, the introduction of winter wheat is making it possible to distribute the labor force and the water resources more equally over the whole year.

Wheat crops are distributed all over the territory of Sinkiang. In fact they are to be found wherever there is the smallest patch of cultivated land. Nevertheless the greater part of all of the area

sown to wheat - around 3/4 - is concentrated in three large agricultural regions: 1) in the basin of the Ili river; 2) in the northern foothills of the Tien Shan, and 3) in the basin of the upper course of the Tarim river. (See Figure 1, page 130)

The basin of the Ili river as well as the basins of its sources - the Kunges and the Tekes and its many tributaries, is the largest granary in northern Sinkiang. Around 18% of all the area sown to wheat is concentrated in this section. Spring wheat is the most important crop in the Ili basin: 33% of all the sown area is sown to spring wheat. Winter wheat was not cultivated here at all until 1949 and at the present time its importance in the sown area is growing rather slowly; in 1955 a total of 0.5% of all the sowing was sown to winter wheat in the basin of the Ili river. ("Sinkiang Jih-pao" 3 September 1955 and 9 May 1956).

Most of the wheat is concentrated in the valley of the Ili river from the point where the Kunges and the Tekes join as far as the Soviet border. Up to 2/3 of the wheat sown in the Ili river region is concentrated in this section. The valley of the Tekes is less important in this respect, around 1/4 of the area sown to wheat is concentrated here. The rest of the wheat area is in the valley of the largest tributary of the Ili - the Kash river, and mainly in the suburbs of the city of Nilki and to a lesser extent in the valley of the Kunges.

The second region is made up of a series of oases which are irrigated by small rivers which flow down from the northern slopes of the Tien Shan. Large fields of wheat run from Mu-lei Ho in the east to Shih Ho in the west. This region grows a little less wheat than the Ili river basin and around 15-16% of all the wheat production in Sinkiang. Spring wheat is the predominant crop at the present time and occupies around 3/5 of the whole area sown to this crop, but winter wheat is also important in this region. Around 12-13% of all the winter wheat grown in Sinkiang is concentrated in this region. To the west of Urumchi, winter wheat prevails over spring wheat, 2/3 of all the winter wheat grown in this region is located here whereas east of Urumchi are concentrated 2/3 of the spring wheat grown in this region and the winter wheat is in second place here.

The third largest wheat producing region includes the basins of the main tributaries of the upper Tarim river: the Muzart, Aksu, Kashgar, Yarkend and Khotan. About 42% of all the area sown to wheat in Sinkiang is situated here. Characteristically in this region, winter wheat is predominant over spring wheat. Around 70% of all the winter wheat grown in Sinkiang is concentrated here and only about 16% of the spring wheat. The only large areas sown to spring wheat are on the upper reaches of the Khotan, in the Aksu basin and in the region around Bay city (the basin of the Muzart). In the other regions of Sinkiang, spring wheat is predominant.

Varieties of winter and spring wheat, which are well-adapted to local conditions have been introduced into Sinkiang; several Soviet varieties of wheat have been widely recognized in recent years.

Among the Soviet varieties of winter wheat, the most widely used is "Ukrainka 0246"; around 12% of all of the area sown to winter wheat is sown to this variety of winter wheat. It has been used most extensively in northern Sinkiang where its yield is 10-20% higher than the yield of the local varieties. It withstands the winter well in this region where the snow covering lies at from 20-30 centimeters.

The natural conditions prevailing in Southern Sinkiang - the absence of snow cover in the winter and the higher content of salt in the soils - have proven to be unfavorable to "Ukrainka 0246". A large part of the sowings of this sort of wheat perish; at best they ripen but yield a much lower harvest than the local southern Sinkiang varieties of winter wheat.

A less wide-spread variety of Soviet winter wheat is "Novoukrainka 83". This variety has also shown much better results in northern Sinkiang than in the southern part of this region.

The local varieties of winter wheat, used in northern Sinkiang, are highly resistant to frost and drought and can withstand a good deal of salt. The southern Sinkiang varieties are excellently suited to the local conditions - the snowless winter, the dry spring-summer period, and the highly salty soils. They yield a fairly high and regular harvest: an average of 19-20 centners per hectare and a maximum of up to 64 centners per hectare.

One positive aspect of the northern local varieties of winter wheat as well as the southern varieties is that they do not collapse, whereas "Ukrainka 0246" must be harvested before it is fully ripened because it crumbles. The local varieties yield finer grain; this is particularly true of the northern Sinkiang varieties. One basic disadvantage of the northern and southern Sinkiang local varieties is that they are very likely nolegayut which makes them extremely difficult to harvest with combines.

The best local varieties of winter wheat are very drought-resistant; do not nolegayut and do not crumble. A salt resistant variety has been introduced which is sown in the outer sections of the irrigated systems of northern Sinkiang and on the lower reaches of the Khaydyk-Gol river (Karashar valley) and in certain other places.

In southern Sinkiang and in the Turfan valley, varieties of winter wheat with a short period of vegetation are common. By using these varieties, it is possible to sow and harvest fast growing corn, rice, rape or vegetables in the same year after the winter wheat has been harvested. In the northern foothills of the Tien Shan, east of Urumchi, where the period of above-freezing temperatures is comparatively short, the peasants also prefer to sow the early ripening varieties of winter wheat. The Soviet varieties of winter wheat are much less widely used than the local varieties.

The selection of various kinds of winter and spring wheat in accordance with the requirements of local conditions, is of great importance to increasing agricultural productivity.

The second most important grain crop in Sinkiang is corn which occupies around one fourth of all the area sown to grain and yields more than one third of all the grain. The largest corn growing areas are concentrated in southern Sinkiang. More than 4/5 of all the corn is grown in the basin of the upper Tarim. The oases which are irrigated by the small rivers of the northern foothills of the Kunlun, also play quite an important role in corn production, especially the Chira and Keriya oases. The basins of the Muzart and the Konchedarya are less important in this respect.

In northern Sinkiang the area sown to corn is small - no more than 4-5% of the corn is concentrated here and these sowings are very scattered since there are no specialized corn producing regions here. (See Figure 2, page 132)

In 1955, the area sown to corn in Sinkiang as a whole was 25% greater than in 1949. This growth was particularly noticeable on the upper reaches of the Yarkend and Khotan rivers and somewhat less noticeable in the Kashgar basin, whereas in the Ili river basin the area sown to corn was drastically reduced.

One of the reasons for the fact that corn is so widely grown in southern Sinkiang is that it can be sown much later than spring wheat - in the early summer. When flooding occurs here, the peasants have enough water for watering the fields.

Corn is very important in repeated sowing. After the wheat harvest, up until the first frosts in southern Sinkiang, there remains a fairly long period (in some regions - as much as 100 days) with average monthly temperatures of 20-25°. During this period the peasants use the surplus water for repeated sowings of corn, rice, peas, rape and other crops. Of these crops, corn is proportionately the largest.

Late corn is usually sown in southern Sinkiang at the end of June and the beginning of July. On rare occasions it is delayed until July 20 in which case the most early ripening variety is used which is the lowest yielding of all the varieties of corn and is called "taztsilik" - it has a vegetational period of 75 days. The corn is harvested at the end of September and the beginning of October before the fall ploughing. If the grain has not finished ripening, the corn is gathered and put in silos at the stage of wax (voskovoy) maturity. The yield of late corn is 9-12 centners per hectare on an average.

At the present time repeated sowings of corn and certain other crops (rice, rape, etc.), are most common in the Khotan and Moyuy hsien where 70% of the whole arable area is sown repeatedly; in other regions repeated sowings are practiced to a much lesser extent. In the Aksuy and Kashgar oases for instance, the area of repeated sowings is a total of 20-30% of the sown area. Thus it can be seen that an extension of the area sown more than once is an important reserve for the development of agriculture.

The third grain crop of Sinkiang is rice. This crop lays way behind wheat and corn in importance and in its share of the total sown area, which is no more than 4%. In the grain production of this region, rice makes up no more than 9%.

As far as temperatures are concerned, rice can be grown almost everywhere in Sinkiang with the exception of the Altai region but because this crop requires high standards of watering, it is grown only in the regions which are well supplied with water, which is mainly in the western section of the foothills of the Tien Shan and the Kunlun. The rice is sown primarily at the points where the rivers flow out of the mountains onto the plains, inasmuch as lower down the rivers, as a rule, begin to suffer from a lack of water. Because of this, in Sinkiang, several small rice growing centers have grown up where the great majority of the rice fields are concentrated.

The largest rice growing centers are in southern Sinkiang which yields around 2/3 of the total rice harvest. In northern Sinkiang the rice growing centers are smaller. Most of them lie in a kind of chain in the foothills of the Tien Shan, west of Urumchi. Several rice growing centers are located in the basin of the Ili river, the most important of these is Kul'dzha and the less important centers of Chabuchar, Suydin and Khorgos. (See Figure 3, page 133)

From 1949 to 1955, rice sowing in Sinkiang grew by more than 1/4. The rice areas on the upper reaches of the Yarkend and the Khotan showed a particularly large increase during this period. In the other regions, this development was less noticeable and in some places (the northern foothills of the Tien Shan and the basin of the Ili) the rice fields were even somewhat reduced.

Besides the afore-mentioned three important grain crops, more or less important positions are held by kaoliang, barley and millet in the agriculture of Sinkiang. These crops were especially important up until 1949, in recent years they have been gradually replaced by more valuable crops like wheat and corn. Up until 1949, around 4% of the whole sown area was under kaoliang whereas in 1955 it made up around 2% of this area. The area planted to kaoliang was reduced in absolute figures by around 20%. At the present time kaoliang is grown most extensively in the Kashgar basin, in the Turfan valley and on the northern foothills of the Tien Shan. There are also less significant areas planted to kaoliang in the Khamiy hollow and in Chabuchar and Suydin hsien (the Ili river basin).

In 1949 more than 3% of the whole sown area of Sinkiang was under barley, whereas in 1955 - this area was a little more than 2%. The absolute reduction in the area sown to barley during this period was around 8%. This reduction took place chiefly by replacing barley fields with water land. Barley completely disappeared from the basin of the Aksu river where previously 1/6 of all the barley sown in Sinkiang was concentrated. Barley was sharply reduced in the basin of the Kashgar, in the hollows lying between the mountains and in the

northern foothills of the Tien Shan. At the present time, barley is grown most extensively in the regions of bogarnyy crop cultivation; the area sown to this crop has grown somewhat in this region in recent years. The largest barley producer is the basin of the Ili river and particularly the valley of the Tekes. There are also fairly large areas sown to barley in the region of the city of Chuguchak and in the Mongolian Altai region. In southern Sinkiang, barley is grown primarily on the upper reaches of the Yarkend. The only other region known for its barley production is Tashkurgan Hsien.

The millet crops diminished in the period from 1949 to 1955 by almost five times. The share of the sown area of Sinkiang under this crop was reduced from 4.6 to 0.7%. They altogether stopped growing millet in the southern foothills of the Tien Shan and in the basin of the Yarkend where formerly this crop was fairly widespread. At the present time, millet is still being grown only in the region around Kul'dzha and Suydin, in the northern foothills of the Tien Shan, in the Kashgar oasis and in the Gum oasis.

Oats are not grown very extensively in Sinkiang; this crop is found only in the basin of the Ili river, on the outskirts of Chuguchak and in the mountains of the Mongolian Altai.

Improvement in agro-technology, universal introduction of the most fruitful types and varieties of grain forage crops along with the larger areas sown to these crops, have allowed for a considerable increase in the grain harvest.

These achievements in the development of crop cultivation have made it possible to liquidate the food deficit in Sinkiang. Before the liberation, there was not enough grain in Sinkiang, and each year a fairly large amount of grain was imported into Urumchi and Khami from the province of Kansu. After the liberation and as early as 1952, Sinkiang was basically guaranteed self-sufficiency in grain.

Development of Cotton Growing

Until the establishment of the people's regime, Sinkiang was not able to exploit to any considerable extent its potentialities as a producer of technical crops and particularly cotton, because it did not have its own industry for processing agricultural raw material and was essentially cut off from the interior regions of China where this raw material could have been processed and was in demand. Just as the small peasant farms were not able to meet the task of satisfying Sinkiang's demands for food and fodder, the introduction of technical crops was also very limited.

After the victory of the people's revolution, agrarian reforms were instigated, large cooperatives and state farms were formed, industry was developed and economic ties with the interior were strengthened. Thus the prerequisites were set up for a swift change in the structure of the sown area of Sinkiang in favor of technical crops. In recent

years the rate of development of technical crop production is far ahead of the speed at which the production of food crops is developing. From 1949 to 1958, the share of food crops in the sown area of Sinkiang was reduced from 85.3 to 80.3%, and the technical crops grew correspondingly from 8.4 to 15.9%.

The area sown to technical crops is about equally divided between oil crops and cotton. The oil crops are sown almost everywhere in Sinkiang, with the exception of one of the regions of the Mongolian Altai (Chingil and Koktogoy hsien); most of the production of this crop comes from the regions on the upper Tarim, the basin of the Ili river and the northern foothills of the Tien Shan.

Cotton growing was comparatively undeveloped in Sinkiang up to 1949: in 1949 2.8% of the whole sown area was planted to cotton. After the liberation, cotton growing began to develop at a very swift speed.

Southern Sinkiang and the Turfan valley possess the necessary conditions for cotton cultivation.

TABLE

The sums of actual temperatures and the duration of the period above-freezing in southern Sinkiang*

Region	Sum of temperature above 10°	Duration of above-freezing period, in da
Northern extreme of the Tarim valley	3700-4000°	170-180
Southern extreme of the Tarim valley	4300-4500°	200-220
Turfan valley	5000-5500°	200

* Atlas of the Chinese People's Republic, 1957; Climatic Atlas of China, 1953.

The almost complete lack of clouds in southern Sinkiang provides a large amount of sun light; the innumerable rivers, when regulated, can irrigate a sufficiently large area of fields. In the southern extreme of the Tarim valley, high yielding average-ripening and late-ripening varieties of cotton can be grown successfully; in the northern extreme of this valley, average-ripening cotton can be grown on a wide scale. The Turfan valley could become a base for long-fiber cotton.

In northern Sinkiang, the cotton growing conditions are much less auspicious than in the south. The only place where cotton could be cultivated is the Manas basin. The climatic conditions of this

region would make it possible to grow early-ripening varieties of cotton. The sum of the temperatures higher than 10° in the city of Shih-ho-chi is equal to 3200°, and the period of above-freezing temperatures lasts 151 days. Nevertheless, it must be kept in mind that the sum of warm temperatures as well as the duration of the above-freezing period here is subject to sharp fluctuation and in some years they are way below the requirements of the cotton norms. For instance in the four years from 1953-1956, the sum of temperatures above 10° was less than 3000° in 1954 and in 1956, and the above-freezing period was less than 150 days. In years like this, the percentage of low-quality post-freezing cotton is very high.

The main mass of the cotton - around 4/5 - is concentrated in southern Sinkiang (Teng Ching-chung, 1957) including 25% in the Kashgar basin, 18% in the Yarkend basin, 10% on the upper Khotan, 10% in the Muzart basin and 8% in the Aksu basin. (See Figure 4, page 134). Besides climatic conditions, another important factor favors cotton growing in southern Sinkiang - this is the great density of the population. Cotton, as is well-known, is a very labor demanding crop and requires a lot more work than all the other crops cultivated in Sinkiang. The large labor resources of southern Sinkiang guarantee a high level of agro-technology and opportune gathering of the harvest.

In all the oases of Southern Sinkiang, a stable food base has already been established and in many of the regions (for example, the Aksu oasis) there is a large surplus of grain. In view of the fact that the urban population of southern Sinkiang is growing at a much slower rate than it is in the north, further cotton growing specialization in the agriculture of this region cannot cause any difficulties in providing the population with food.

The most negative aspect of developing the cotton growing economy of southern Sinkiang is its great distance from the textile industries both of Sinkiang itself (Urumchi city) and (to an even greater degree) from the eastern regions of China. This is particularly true of the southern extreme of the Tarim valley. To transport the cotton by truck over thousands of kilometers would be very expensive. However in the near future, it is planned to build a railroad in southern Sinkiang; moreover, part of the cotton will be processed in the cotton enterprises which are now being built to satisfy the local textile needs.

Around 10% of the cotton sown in Sinkiang is concentrated in the Turfan valley (Teng Ching-chung, 1957). The climatic conditions of this region are exceptionally favorable for growing long-fiber cotton and the advantageous geographical position of this region on the main lines of communication between the eastern regions of the country and northern and southern Sinkiang, near the large grain producing centers, warrant a complete exclusion of grain forage crops from this area and the transformation of this valley into a cotton and grape growing center.

In northern Sinkiang is concentrated around 15% of the cotton crop ("Sinkiang Jih-pao", 29 April 1956). Almost all of this cotton is located in the Manas basin. Until 1949, cotton was not cultivated at all in northern Sinkiang. In recent years cotton growing has begun to develop in the Manas basin at a swift rate, much faster than it has in any other region of Sinkiang. From 1950 through 1956, the area sown to cotton increased 97 times. Whereas in southern Sinkiang and in the Turfan valley, the cotton growing is handled mainly by the local population, in the Manas basin 95% of the sown area belongs to state farms.

As was pointed out earlier, the climatic conditions of this region though they allow for the development of cotton growing here, do not guarantee a stable yield and a high quality of cotton. The comparatively sparse population of this region makes it impossible to achieve a high level of agro-technology in many of the areas where cotton is sown; it also delays the gathering of the harvest. Moreover, the basin of the Manas is situated near large and fast-growing agricultural centers such as Urumchi, Kushantszy (Tushandzy) and Karamay, for which it must supply grain, vegetables, milk and meat.

Consequently cotton growing cannot become the main branch of agriculture in the Manas basin. Here the grain economy and vegetable growing will develop above all else. During the second five-year plan (1958-1962), the main cotton growing base of the state farms will be moved from northern Sinkiang to the south, because cotton growing will be of only subsidiary importance in the Manas basin.

Before the liberation, the largest area in Sinkiang was occupied by the short-fiber low-quality variety of cotton called Gossypium herbaceum. Despite the fact that in the 1930s, a better quality and more fruitful variety of cotton called Gossypium hirsutum was imported from the Soviet Union, the sowing of this variety remained relatively limited. After 1949, Soviet varieties of cotton began to be introduced extensively: in 1949 they made up less than 1% of all the cotton grown here, and in 1956 - 88%. By increasing the amount of high-yielding varieties of cotton and improving agro-technology, it was possible to raise the cotton harvests to an even greater extent than the sown areas were increased. (Production, Demand and Supply of Cotton in Sinkiang, 1957).

The average cotton yield in Sinkiang up to 1953 was lower than the average for the country. As of 1953, Sinkiang far surpassed the all-Chinese indices, and in 1955 the cotton yield here was 37% higher than the average for the country.

At the present time, Sinkiang still yields a comparatively small part of the gross cotton harvest of the country; about 3% in 1958. But the favorable climatic conditions, large areas of virgin land and huge water resources allow for a considerable increase in cotton production and will make it possible to turn Sinkiang into one of the main cotton producers of China.

BIBLIOGRAPHY

Atlas of the Chinese People's Republic Peking - Shanghai, 1957 (in Chinese).

Report on an Investigation of Bogarnny Agriculture in the Basin of Ili River. "Scientific Bulletin of the Institute of Agriculture and Forestry of Sinkiang," 1957, No. 9 (in Chinese).

Teng Ching-chung. Cotton Production in Sinkiang. "Ti-li Chih-shih", 1957, No. 5 (in Chinese).

Climatic Atlas of China. Vol. 1 Peking, 1953 (in Chinese).

Course in the Economic Geography of China, Vol. 2, Chapter 10. Peking, 1956 (in Chinese).

Production, Demand and Supply of Cotton in Sinkiang. "Chi-hua yueh t'ung-chi", 1957, No. 4 (in Chinese).

Uzbek SSR. Moscow. 1956.

Economic Situation of Sinkiang Uighur Autonomous Region. "Chi-hua yueh T'ung-chi", 1957, No. 4/5 (in Chinese).

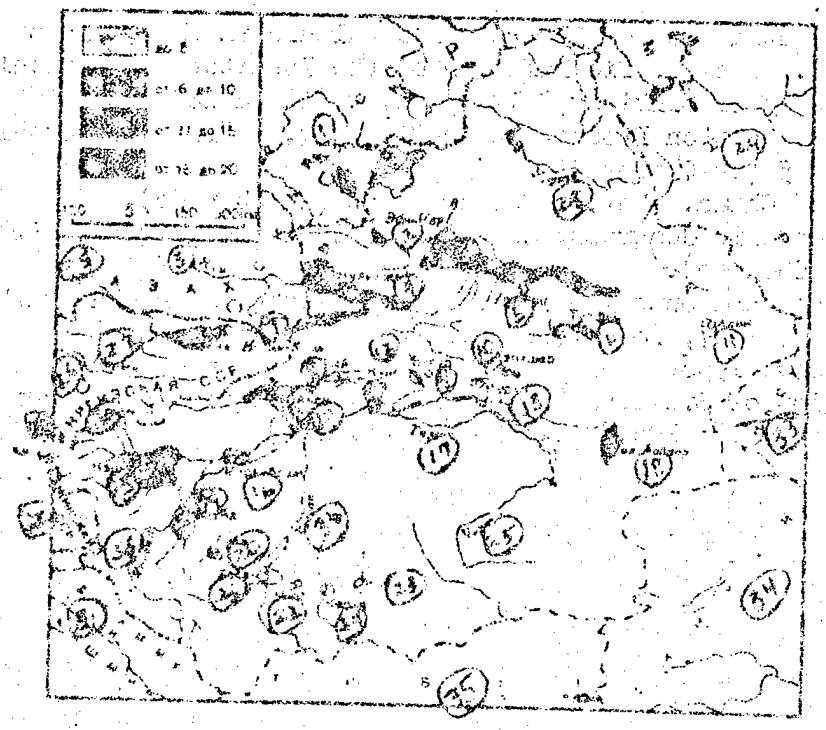


Figure 1. Wheat crops in the oases in percentages of the total area sown to wheat in Sinkiang.

up to 5

from 6 to 10

from 11 to 15

from 16 to 20

Legend to Map

1. Chuguchak
2. Ebi Nor
3. Ili River
4. Kuldja
5. Urumchi
6. Turfan
7. Lake Issyk Kul'
8. Pai
9. Bugur
10. Karashar
11. Hami
12. Kucha
13. Kurlya
14. Aksu
15. Kashgar
16. Maralbashi
17. Tarim River
18. Lop Nor
19. Yarkend
20. Guma
21. Khotan
22. Chira
23. Niya
24. Keriya
25. Kazakh SSR
26. USSR
27. Naryn River
28. Urungu River
29. Mongolian Peoples Republic
30. Kirghiz SSR
31. Jammu and Kashmir
32. Tadzhik SSR
33. Kansu Province
34. Tsinghai Province
35. Tibet
36. Khotan River
37. [Not used]
38. Yarkend River

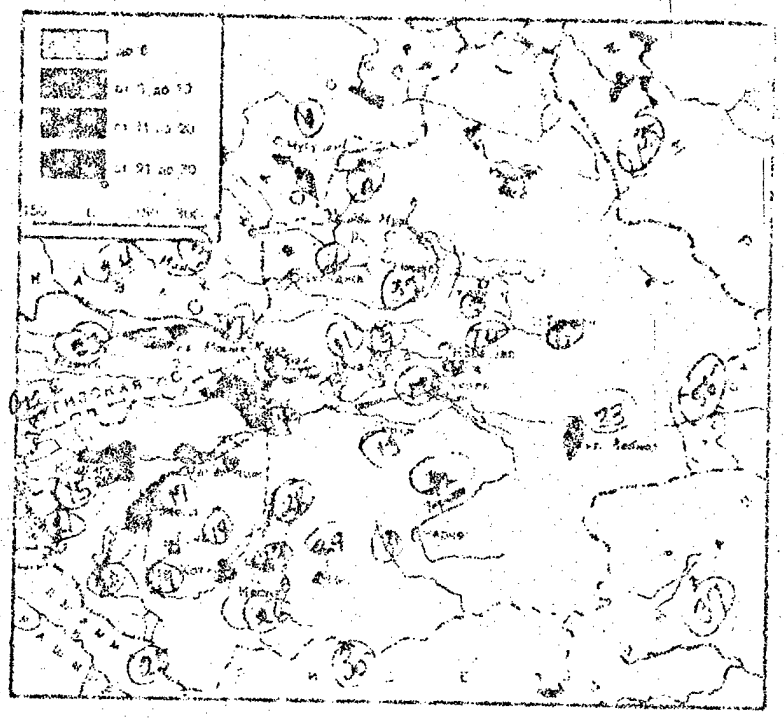


Figure 2. Corn crops in the Oases in percentages of the total area sown to corn in Sinkiang.

Legend:

1. Chuguchak
2. Ebi Nor
3. Ili River
4. Kuldja
5. Urumchi
6. Turfan
7. Lake Issyk Kul'
8. Pai
9. Bugur
10. Karashar
11. Kucha
12. Kurlya
13. Tarim River
14. Aksu
15. Kashgar
16. Maralbashi
17. Yarkend
18. Guma
19. Khotan
20. Yarkend River
21. Tadchik SSR
22. Kirghiz SSR
23. Karyn River
24. Kazakh SSR
25. Jammu and Kashmir
26. Keriya
27. Chira
28. Khotan River
29. Niya
30. Tibet
31. Cherchen
32. Cherchen River
33. Lop Nor
34. Urunga River
35. Mongolian Peoples Republic
36. Kansu Province
37. Tsinghai Province

up to 5 | from 6 to 10 | from 11 to 20 | from 21 to 30

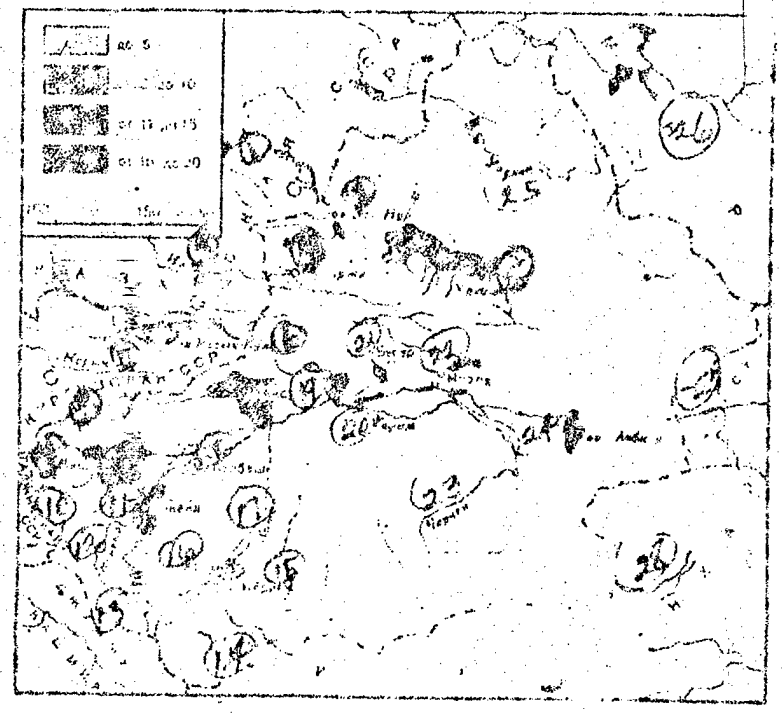


Figure 3. Rice crops in the oases in percentages of the total area sown to rice in Sinkiang.

Legend

1. Kazakh SSR
2. Ebi Nor
3. Ili River
4. Kuldja
5. Urumchi
6. Lake Issyk-Kul'
7. Naryn River
8. Kirghiz SSR
9. Kashgar
10. Tadzhik SSR
11. Yarkend
12. Yarkend River
13. Jammu and Kashmir
14. Tibet
15. Keriya
16. Khotan
17. Khotan River
18. Maralbashi
19. Aksu
20. Tarim River
21. Pugur
22. Kurlya
23. Cherchen River
24. Lop Nor
25. Urunga River
26. Mongolian Peoples Republic
27. Kansu Province
28. Tsinghai Province

up to 5

from 6 to 10

from 11 to 15

from 16 to 20

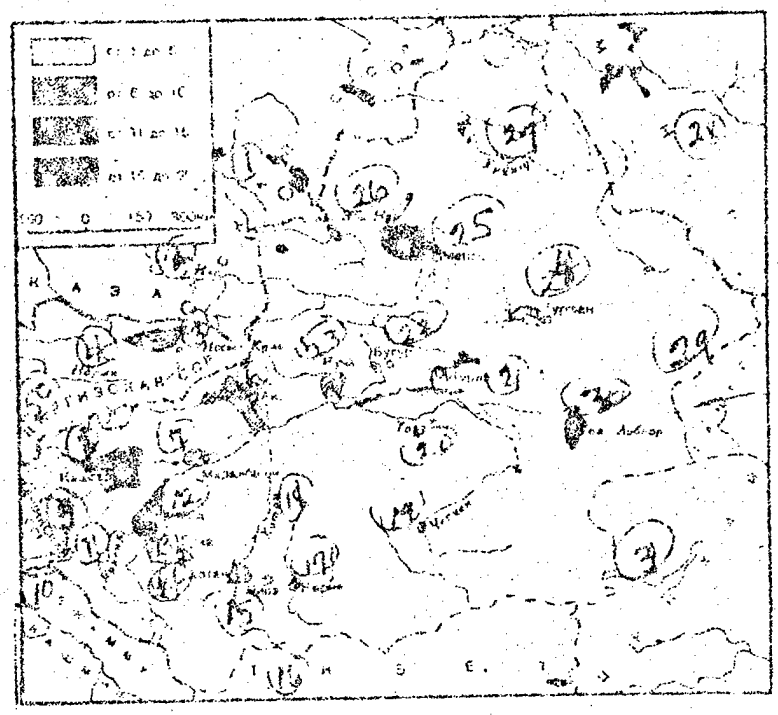


Figure 4. Cotton crops in the oases in percentages of the total area sown to cotton in Sinkiang.

Legend

1. Kazakh SSR
2. Ili River
3. Lake Issyk Kul'
4. Naryn River
5. Kirghiz SSR
6. Aksu
7. Maralbashi
8. Kashgar
9. Tadzhik SSR
10. Jammu and Kashmir
11. Yarkend River
12. Yarkend
13. Guma
14. Khotan
15. China
16. Tibet
17. Keriya
18. Khotan River
19. Cherchen River
20. Tarim River
21. Kurlya
22. Bugur
23. Kucha
24. Turfan
25. Manas
26. Ebi Nor
27. Urungu River
28. Mongolian Peoples Republic
29. Kansu Province
30. Lop Nor
31. Tsinghai Province

from 1 to 5 from 6 to 10 from 11 to 15 from 16 to 20.

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- END -